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O. P. BRYSCH, Editor — P. J. CHATTA, Assistant Editor

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1. MANAGEMENT

Gas Industry Expansion

The Gas Industry in Europe, 1960. O.E.E.C. Gas Committee. (Paris: Organisation for European Economic Co-Operation, Oct. 1960; 109 pp.)

First part of report is concerned with production and consumption of the different kinds of gas (gasworks, coking plant, blast furnace, producer plant, natural gas and refinery tail gases); the competitive position of gas on the fuel and power market; and a review of the technical aspects of transporting gas from the Sahara or from other sources outside Europe. Part II deals with production and demand in the United States.

$2,219 Millions to Be Spent by Gas Industry in 1961. *Pipe Line News 33,* 20 (1961) Jan. (2 pp.)

Currently serving more than 33½ million customers and growing at an annual rate of about 1 million customers, the gas industry has spent an estimated $1890 million for new facilities during 1960. This is 6.7 per cent above the previous records of $1772 million set in 1957, and 9.4 per cent ahead of 1959 outlays of $1728 million. The gas industry's gross plant at the close of 1960 is estimated at $21,850 million, compared with $19,840 million the previous year. Construction is under way or projected on five U.S. pipelines, through which more than 1 billion CF/day of gas will be imported from Canada during 1961.

How Southern Counties Now Houses Itself. *Gas 37,* 45 (1961) Feb. (19 pp.)

Southern Counties Gas Co. of Los Angeles has been one of the fastest growing companies in the gas industry, and housing the people who supply a community with gas can be a complex problem. Because it is believed that other companies will eventually be faced with reorganizing and expanding facilities for personnel, the editors present a logical development of the housing story, beginning with the abandonment of the old philosophy, continuing on to functional specifications and how they molded the new general office building, and a pictorial portfolio of one of the division headquarters.

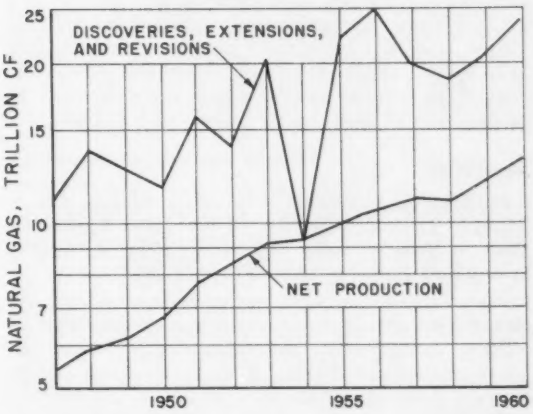
The Go-Ahead for Canadian Natural Gas. *Petrol. 24,* 16 (1961) Jan. (2 pp.)

Two of the most important developments in Canada's natural gas industry during 1960 were the granting of the necessary import permits by the United States, in September, that have given the go-ahead to the construction of the Alberta-California gas pipeline, and the news in October that gas had begun flowing to the U.S. Midwest through the $52-million pipeline system of the Midwestern Gas Transmission Co. When both of these projects finally come into operation, Canadian gas production is expected to reach 3500 MMCF/day.

The Fuel Industries in Russia. J. Burns. *Coke and Gas 23,* 6 (1961) Jan. (3 pp.)

Author is a member of the Council of the International Gas Union, in which capacity he recently attended an I.G.U. meeting in Moscow and Leningrad. While he discusses coal, oil, electricity and natural gas, he contends that the most important development in the fuel industries in Russia has been the increase in natural gas distribution. In 1940, natural gas supplied only about 2 per cent of the total thermal requirements of the country, but today the industry has grown by more than five times, and by 1965, the percentage contribution of natural gas will double and far outstrip the contribution made by oil fuel. Undoubtedly, he says, the major triumph of the Russians has been the development of their distribution system; they undertake to send gas over the many thousands of miles from Uzbeckistan in the south to Siberia in the north, and in this the Russians make use of the very latest techniques in pipelining.

U.S. Gas Discoveries Are Lagging Production



(Adapted from *Gas Use Calls . . .* see abstract, p. 28)

Gas Industry Management

Retrospect on an American Visit. G. B. Scott. *Gas World 153,* 182 (1961) Jan. 28 (2 pp.)

Article contains abstracts of a report by the Woodall-Duckham Educational Award winner, 1960, under which the author attended the summer program at the Institute of Gas Technology. Among the things incorporated in the report are the viewpoints of the Institute's Director, M. A. Elliott, on the long-range consumption of natural gas. He believes that within 10-15 years, transmission costs for natural gas will be so high that delivery of this gas to the northern states will be comparable to the cost of gas manufactured in the northern states. Therefore, manufactured gas will be more extensively used. Other impressions of the U.S. gas industry are included in the article.

Interstate Pipeline Purchases. *Gas Age 127,* 28 (1961) Jan. 5 (5 pp.)

During 1959, interstate natural gas pipeline companies reporting to the Federal Power Commission purchased directly from natural gas producers 7,519,992,780 MCF

of natural gas at a cost of $1,075,052,466. The average cost to the pipeline companies was 14.3 cents/MCF. A total of 270 producers, each reporting sales of 2,000,000 MCF or more, supplied in total 6,788,539,388 MCF or 90 per cent of total pipeline purchases, and received $970,266,977 or 90 per cent of total producer revenues. Natural gas sales to pipeline companies were made by producers in 21 states and in Canada and Mexico.

Appliances

Gains Seen for Appliances in '61. E. R. Martin. *A.G.A. Monthly 43,* 9 (1961) Jan. (2 pp.); **Gas Appliances. 1960: A Year of Sales Depression. 1961: A Brighter Second Half.** *Gas Age 127,* 40 (1961) Jan. 5 (3 pp.)

Although the gas appliance and equipment industry displayed signs of underlying strength in 1960, effects of reduced new housing and other negative economic trends on consumer buying could not be entirely offset. Housing starts are estimated to be down 15.8 per cent in 1960; gas range sales will be down 8.3 per cent, electric range sales (first 10 months) are down 8.3 per cent; gas water heater sales for 1960 will be down 9.9 per cent, and electric water heater sales (first 10 months) are down 19.9 per cent; gas central househeating sales for 1960 will be down 13.4 per cent, the same amount as oil central househeating sales for the first 10 months. Gas industry believes that prospects for an upturn upon resumption of general economic uptrends are bright.

Cost Accounting

Accounting for Gas Line Expansion Project. P. G. LaGrone. *Public Util. Fortnightly 67,* 158 (1961) Feb. 2 (16 pp.)

Many details are involved in planning a pipeline expansion. Accounting techniques, for example, play a major part. Costs must be assembled, analyzed, and projected in terms of budgets and procedures. The role of accounting is described—from the time early studies are conducted to when a project is shown economically feasible, and from the time a certificate of convenience is granted until it is recorded in the plant account records.

Federal Power Commission

[Excerpts from] Report on Regulatory Agencies. J. M. Landis. (Excerpts prepared by H. Zinder & Assoc., Inc.) *Gas Age 127,* 45 (1961) Jan. 5 (4 pp.)

Several suggestions with reference to improving the organization and procedures of certain of the regulatory agencies are contained in the report. Many of these recommendations can be adopted, if deemed desirable, by action of the agencies themselves; others can be incorporated in the plans for reorganization. These plans will be prepared as suggested in the report.

The Gassing Game. J. Clark. *Gas 37,* 21 (1961) Feb. (2 pp.)

Heart of the gas producing country was not too well impressed with the now-famous 29,000-word report by Dean James M. Landis on the subject of regulatory agencies, and especially the Federal Power Commission. In one section of his report, for example, Landis implied that the FPC has been instructed by the courts to regulate producers on a utility basis. The exact opposite is the case, says author. Excerpts from the report are quoted and criticized.

FPC Is Under Heavy Pressure to Aid Gas Pipeline Industry. *Pipe Line News 33,* 18 (1961) Feb. (2 pp.)

Federal Power Commission is under the heaviest pressure in its history to speed up decisions on requests to sell natural gas, to change rates and to build gas pipeline facilities. In gas and pipeline circles, strenuous protests are being registered over costly FPC delays and its unwillingness to grant a reasonable rate of return to transmission companies. There are hopeful signs that the new administration will alleviate the delay problem.

Look for Rough Treatment Ahead. N. Regeimbal. *Gas 37,* 17 (1961) Feb. (2 pp.)

Controversy regarding the Federal Power Commission, first predicted two years ago by the author, is beginning to take shape. One of the first real interfamily fights between the Kennedy Administration and the Democratic congressional leaders may well erupt over this hapless agency. The seeds have already been sown. Eventually there will be some major shakeups in the agency's system, procedures, and perhaps even its statutory authorities.

Foreign Activities

Rapidly Growing French Natural Gas System Extends to All Areas. J. Grindrod. *Gas Age 127,* 36 (1961) Feb. 2 (3 pp.)

Three years of construction have created a 1650-mile pipeline network linking Lacq Field with all major markets. One major feature will be a sulfur recovery equal to nearly one-sixth the world supply. From the Lussagnet storage, near Lacq, southwest France, a single trunk line takes the entire northbound purified gas supply to a pumping station at Chazelles; thence the main arteries fan out to Nantes, the east-central district of France, Lyon, Dole and Paris by the Chazelles-Nantes, Roussines-Vindecy, Vindecy-Le Peage de Rousillion and Ars-Brignais, Vindecy Dole and Roussines-Epinay sur Seine lines, respectively.

A Report on the LP-Gas Industry in Russia. C. L. Adams. *LP-Gas 21,* 23 (1961) Feb. (3 pp.)

Largely because of a national policy favoring coal over oil and gas, the Russians are far behind the United States in their development of an LPG industry. At a time when the United States is considering a National Fuels Policy which would guarantee coal markets, the USSR has recognized the long-neglected merits of LPG and has undertaken a crash program to develop production, transportation and consumer facilities.

French Are Pushing Plans to Move Sahara Gas to Europe. *Petrol. Week 12,* 44 (1961) Jan. 20 (2 pp.)

In April, production of the substantial Sahara field, Hassi R'Mel, will begin at the rate of 17.6 billion CF/yr. Ultimate reserves are estimated to be at least 35.3

trillion CF. Initially, gas will be carried to customers in the industrialized areas on the Mediterranean Coast of Algeria. But ultimate reserve figure shows why producers in the field are pushing plans to tap it on a much larger scale, and this means finding markets across the Mediterranean Sea in Europe. Market surveys, spurred by French plans for a trans-Mediterranean pipeline to Europe, are underway.

Hydrogen

Research on the Hazards Associated with the Production and Handling of Liquid Hydrogen. M. G. Zabetakis and D. S. Burgess. *U. S. Bur. Mines Rep. Invest. 5707,* (Washington, D. C.: U. S. Dept. of the Interior, 1961; 50 pp.)

Use of liquid hydrogen as a high-energy fuel introduces numerous hazards not ordinarily associated with the use of other more conventional fuels. These hazards are attributable to the unique properties of hydrogen in the liquid and gaseous states. Since little work has been conducted on explosion and related hazards of cryogenic fuels, a research program was undertaken to obtain basic data. These data were used to outline emergency procedures for protecting personnel and equipment when an accidental spillage of liquid hydrogen occurs and to establish a quantity-distance table for storage.

Maintenance

Can You Measure Maintenance Performance? T. B. Foster. *Petrol. Refiner 40,* 123 (1961) Jan. (6 pp.)

Author believes that maintenance performance can be measured through a searching analysis of factors governing good maintenance. Check lists in article provide a starting point. Maintenance audit has demonstrated these advantages: simple numerical expression of status and accomplishment; useful method for evaluation of the many intangible factors involved and for establishment of common definitions, objectives and values; and a realistic method of comparison in management control between plants without having to factor by differences in plant size, age, condition, complexity or severity of processes.

Operations Research

Operations Research: A Progress Report. J. C. Hetrick. *Chem. Eng. 68,* 137 (1961) Jan. 23 (7 pp.)

Having gone from one extreme to the other—big minds working on small problems to the panacea for everything—operations research is now coming of age, in a survey taken by publication. Not one of the companies reporting the use of operations research intended to discontinue the program. Of the 234 companies commenting on future plans, only two indicated an intention to reduce the rate of activity, and 95 contemplated no change until the existing program could be evaluated.

Pipeline Construction

Alaska Gas Deal Bogs Down. *Business Week No. 1642,* 89 (1961) Feb. 18 (3 pp.)

Article probes the effects of the failure to complete the Kenai to Anchorage line of the Alaska Pipeline Co. The company, owned and operated by R. B. Baldwin of Houston, Texas, had planned to be selling gas in Alaska this winter, but a construction failure by the contractor at Turnagain Arm has postponed plans. Details of the line as an investment probability are discussed, and future plans projected.

Colorado-California Line Gets FPC Okay. A. Yates. *Pipe Line News 33,* 18 (1961) Jan. (3 pp.)

El Paso Natural Gas Co., Colorado Interstate Gas Co. and Southern California Gas Co. will pool big money into a working force which will give Southern California an additional 470 MMCF/day of natural gas. In addition Colorado's Rocky Mountain customers will get increased service. Colorado Interstate will build a 155-mile 34-in. line from Rock Springs, Wyo., to Provo, Utah, where it will connect with a 394-mile, 34-in. line to be built by El Paso extending to the California-Nevada border near Las Vegas.

Safety

Is Maintenance Safety Out of Hand? D. T. Smith. *Petrol. Refiner 40,* 129 (1961) Jan. (6 pp.)

Question answered in article is whether or not safety precautions required are out of proportion to the risk involved—thereby increasing maintenance costs unnecessarily. Also considered: what is the optimum safety level and how is it attained.

Safety Regulations for Radioisotopes. J. R. Mason. *Mech. Eng. 83,* 47 (1961) Feb. (5 pp.)

Radioisotopes represent the first—and so far the most valuable—peaceful application of atomic energy. Article outlines the licensing and regulatory procedures by which the Atomic Energy Commission assures safety in their use. Author cautions that management should take an active interest in control procedures set up by the trained personnel within the organization and establish strong administrative control of the program. Responsibility is not only an internal matter, but one of good public relations as well.

Utility Regulation

Consumer's Welfare Is Main Case for Gas Rate Regulation. *Can. Gas J. 53,* 22 (1960) Dec. (2 pp.)

Opinion of Canadian regulatory authorities is presented in answer to prior article (see *Gas Abstracts 17,* 1). Authorities believe that the case for rate regulation of natural gas companies depends mainly on the fact that a natural gas distributor has a monopoly in his area of a product which the individual consumer cannot quickly or easily change over from or dispense with. The case further depends upon most customers being individually powerless to right a wrong, or unaware that a wrong is being committed. These are, in fact, the basic reasons for all public utility regulations, both of rates and services. They note that in the United States regulated public utilities have in general supplied power more cheaply than unregulated utilities. Even with mediocre examples of regulation this appears to have been the case.

2. ENERGY SUPPLY AND ECONOMICS

Competition

Ten Ways We Fail to Meet Electric Competition. Pricing to Meet Competition. C. C. Turner. *LP-Gas 21,* 26 (1961) Feb. (4 pp.)

In the third article of his series, author discusses the failure of LPG dealers to adjust their prices to meet electric competition. Comparative pricing of LPG and electricity requires the establishment of relative energy usages for identical purposes. When the available services of the LPG industry exceed those available from electricity, then there is no basis of comparison excepting to evaluate those extra services and charge extra.

Electricity

A Decade of Electric Utility Fuel Experience. M. E. Robinson and W. L. Kurtz. (New York: ASME Paper No. 60-FU-1; 13 pp. $1.00/copy; $0.50 to members.)

Paper is based largely upon a recent study of the postwar fuel consumption experience of electric utilities in the United States. Data employed are from reports filed with the Federal Power Commission by all but a very small number of the nation's electric power companies. Inclusion of this segment, even if adequate statistics were available, would have little if any effect upon the findings established in the study.

Design and Operation Results of a 25,000 kw Free-Piston Power Station. M. Barthalon. *Gas and Oil Power 56,* 25 (1961) Jan. (4 pp.)

Societe Le Nickel of New Caledonia operates in Noumea, near Australia, a very large metallurgical plant which processes nickel ore to produce ferro-nickel alloys. In 1959, the four new electric furnaces, plus auxiliaries, added asked for roughly 50,000 kw. Simultaneously, a large hydraulic power station, under construction since 1953, was commissioned 40 miles away from Noumea with a total installed power of 76,000 kva. It was soon realized that a thermal power station was necessary in order to permit continuous operation of the processing plant. A survey showed that free piston engines were the best choice. Article describes first year of operation.

Fuel Cells

75-kw Fuel-Cell Package Uses Sodium Amalgam. *Power 105,* 79 (1961) Feb.

Article briefly describes prototype fuel cell that operates on a mercury amalgam of sodium, oxygen and water. It develops twice the voltage of hydrogen cells, and in contrast to the hydrogen-oxygen cell, promises a sharp cut in overall plant size.

Gas Reserves

TGT Buys Pan Am's Bastian Bay Gas. *Oil Gas J. 59,* 86 (1961) Feb. 6 (2 pp.)

Tennessee Gas Transmission Co. and Pan American Petroleum Corp. have disclosed a $150-million-plus deal involving more than 1 trillion CF of gas. TGT is taking over Pan American's producing leaseholds in Bastian Bay, Palquemines Parish, La., and thus adding the huge reserves to its own gas supply. The company did not disclose any plans for this new supply. In the past, TGT sought the Bastian Bay reserves for either transport to California or to exchange for Texas reserves which would be routed west instead of east.

Gas Use Calls for More Gas Wildcats. J. C. Casper. *Oil Gas J. 59,* 144 (1961) Feb. 13.

If gas producers expect to keep up with the rapidly expanding demand for natural gas, they will have to shift an even larger portion of the exploration budget to the search for gas, observes author. Chart (see page 25) compares net production of natural gas with annual discoveries and extensions plus revisions in reported reserves. Graph is plotted on a semilog scale. On such a scale, a straight line over a period indicates a constant percentage gain. Despite year-to-year variations, there was a general upward trend for the period 1947-56. For the past four years, the trend seems to be leveling. Author briefly discusses the implications shown graphically.

LPG

LP-Gas Sales Up 10.5 Per Cent over Previous Year. G. R. Benz, W. F. DeVoe and A. F. Dyer. *A.G.A. Monthly 43,* 11 (1961) Jan. (4 pp.); **LP-Gas: 1960—Nearly 10 Billion Gallons; 1961—Continued Gains in Sales.** *Gas Age 127,* 36 (1961) Jan. 5 (3 pp.); **LP-Gas Sales Approach 10 Billion Gallons in 1960.** *LP-Gas 21,* 29 (1961) Feb. (6 pp.)

In 1960, LPG sales continued to rise with an apparent increase of 941,000,000 gallons which sent total sales to an estimated 9,860,000,000 gallons. By category, the 1960 sales figures line up this way: domestic and commercial—up an estimated 393,000,000 gallons, or 10 per cent above 1959 to 4,328,000,000 gallons; motor fuels—up 6 per cent to a total of 943,000,000 gallons; industrial and miscellaneous—about the same as in 1959, 871,000,000 gallons; gas manufacturing—down by about 25 per cent to an estimated total of 137,000,000 gallons; chemical manufacturing—largest gain, up 20 per cent to 3,031,000,000 gallons; rubber components—up 7 per cent to approximately 550,000,000 gallons.

Gas Injection and LPG Recovery in Kuwait. W. C. Renton and B. R. R. Butler. *Petrol. 24,* 11 (1961) Jan. (5 pp.)

Article first describes Kuwait Oil Co.'s 100 MMCF/day gas injection plant in Burgan field. The second part deals with the plants that Kuwait Oil is constructing to produce nearly 200,000 tons/yr of liquefied petroleum gas, the bulk of which is destined for export. Construction of the LPG plant is scheduled for completion by September 1961.

New Source for Hawaii's LPG: Asian Oil. *Butane-Propane News 23,* 50 (1961) Feb. (2 pp.)

Until late last October, all crude oil for Hawaii's LPG originated in the U. S. mainland oilfields. Then a new

refinery was built at Barber's Point on the Island of Oahu, and this facility has subsequently been made the sole source of LPG for Isle Gas. On October 26, a tanker of crude arrived at Barber's Point from Sumatra, marking the capture of the Hawaiian market by Asian petroleum products. Since then, crude has come from both Sumatra and Saudi Arabia. The latter is 7000 miles away.

Natural Gas

Middle East Seeks Ways to Use Surplus Gas. *Oil Gas J. 59,* 95 (1961) Feb. 13.

Saudi Arabia and Kuwait will produce an estimated 750 MMCF/day of associated gas in 1961. Of this amount, the Arabian American Oil Co. is expected to use 90 MMCF/day for producing energy, 405 MMCF/day for direct injection, and 55 MMCF/day for LPG injection. This leaves a surplus of 200 MMCF/day for industrial use that will be available at prices ranging between 5 and 6½ cents/million Btu. But the problem is that plants (industries that could be established in that area of the world) would be too far from markets, and operation and construction costs would be too high. However, a German engineering firm has conducted a study and has come up with a three-part answer to the surplus gas problem. Steps in the plan are briefly discussed.

Petroleum

Review-Forecast. *Oil Gas J. 59,* 103 (1961) Jan. 30 (64 pp.)

Predictions are that this will be a better year for the oil business because of what the industry did for itself in 1960. All of the drilling gain in 1961 will be in wildcats. Plans call for 10,651 wildcats, 36,313 field wells, and 195,538,000 feet of hole. Drilling was down 5013 holes in 1960 to 46,751. Development drilling dropped 10.97 per cent. Wildcats decreased only 4.35 per cent. Condensate and gaswells showed gains. World production of crude climbed above 20,000,000 bbl/day in 1960.

Growing Impact of the Compacts on Motor Fuels in the USA. W. C. Uhl. *World Petrol. 32,* 52 (1961) Jan. (2 pp.)

By 1965, it is fairly certain that the ratio of "economy" to "standard" cars in the United States will be 50-50. The effect of this trend on motor fuel sales is studied by means of interviews with US refinery men. Their forecasts are summarized.

Would World Proration Solve the Problem of Ruinous Surpluses? M. J. Sladic. *Oil Gas J. 59,* 68 (1961) Jan. 16 (4 pp.)

International proration would allow some of the world's most underdeveloped nations to take advantage of their immense oil reserves to move toward self-sufficiency. Furthermore, it would protect the oil industry from ruinous and crippling surpluses. Major drawback is that any nation which accepts proration must of necessity surrender a portion of its individuality and sovereignty, but programs of this nature can be successful. Members of the European economic bloc are enjoying considerable success.

Petroleum Demand

[World Crude] 1960 Demand 21,590,000 b/d. *World Petrol. 32,* 41 (1961) Jan. (2 pp.)

Article gives 1960 statistics, and cites conclusions of M. E. Hubbard, head of economic relations for the British Petroleum Co., who conducted a study of the long-term outlook for relative product demand in Europe. His conclusions: 1) although the gasoline proportion itself will continue to fall marginally, this will be more than compensated by the sales of refinery gas to gasworks and by LPG; 2) fueloil or residuals will drop considerably to below any percentage known in Europe in the last decade; and 3) middle distillations will rise to a proportion considerably higher than in the past.

Petroleum Production

Production Research Must Increase Profitability in the 60's. L. E. Elkins. *Petrol. Eng. 33* (Drilling and Producing), B-30 (1961) Jan. (4 pp.)

Many immediate and long-range objectives will be developed into practical ideas for improving technology, author predicts. These new developments will continue to provide major breakthroughs in reducing costs and accelerating increases in productivity. Impact of research should be considered for long-range planning.

Petroleum Reserves

Estimating Oil Reserves from Production Data. W. F. Stevens and G. Thodos. *Petrol. Eng. 33* (Drilling and Producing), B-46 (1961) Feb. (4 pp.)

Preliminary estimates of oil reserves often may be obtained from geological data, but no information is readily available concerning the extent of primary oil recovery to be anticipated. Calculation procedures can be developed to give this information for the idealized cases of gas-cap drive, internal-gas drive and water encroachment. Although the results of such calculations are valuable, more reliable and easily obtainable estimates of future recovery can be made from actual production data. The longer a field has been on production, the more dependable are these predictions. Three common production decline curves can be used to estimate total oil reserves and total production at abandonment. Selection of the proper curve and evaluation of results are discussed.

Thermoelectricity

An Analysis of Thermoelectric Effects. M. H. Dixon. *J. Amer. Soc. Nav. Engrs. 72,* 255 (1960) May (15 pp.) [From *Appl. Mech. Rev. 14,* 57 (1961) Jan.)]

Review of the technical aspects of thermoelectric effects. In the author's words, "It is presented in the hope that it may save others hours of digging and sorting necessary to sift the facts and theory for a modicum of understanding." G. A. Hawkins, USA

New Power Source Goes to Work. *Business Week No. 1638,* 51 (1961) Jan. 21.

Westinghouse claims first industrial sale of a thermoelectric device that converts heat directly to electricity. It has delivered a 100-watt thermoelectric generator to Northern Illinois Gas Co. for use as a power source for cathodic protection of pipelines and for charging batteries of a microwave relay communications system. The Navy sees use of the devices as silent power sources for submarines, but feels price is a big problem. Possibility for reducing price lies in cutting amount of material used in the cell.

Some Notes on the Possible Application of Thermoelectric Devices to the Generation of Electric Power. P. J. Bateman. Aero. Res. Counc. Lond. Curr. Pap. 499, 16 pp. 1960. [From *Appl. Mech. Rev. 14,* 57 (1961) Jan.]

When waste heat is available in a convenient form, conversion to useful electrical power should be possible by means of thermoelectric devices which, fabricated from semiconductor materials already developed, should give a power output per unit weight comparable with that of conventional small dc power sources. This can only be realized in practice if installation and construction problems can be overcome, and if the effective hot and cold junctions are of the order of 1 cm apart. Efficiencies are, however, so low at present that it is unlikely that thermoelectric devices will be produced for the large-scale production of electrical power.

From author's summary

3. NATURAL GAS AND PETROLEUM PRODUCTION

Drilling

Cable Tools Aid in Arctic Drilling. O. C. Baptist. *Drilling 22,* 65 (1961) Feb.

Wells drilled for the Navy with rotary rigs and warm mud caused the permafrost to melt, and when shut down for testing the formations refroze, plugging the wells. Use of cable tools solved this problem.

Field Test Proves Instruments and Calculations Can Solve Suction Problems. S. L. Collier. *Gas Oil J. 59,* 74 (1961) Feb. 13 (4 pp.)

Instrumentation system, developed for laboratory operation, has now been moved into the field to solve pump operating problems. Pump operation can be improved to eliminate knock.

How to Apply Hydraulic and Bit Horsepower. P. L. Moore. *Oil Gas J. 59,* 77 (1961) Jan. 23 (4 pp.)

If bit horsepower is the basic design criteria for a given jet-bit hydraulics program, four points should be considered: 1) bit horsepower is maximum when the rate of flow is the minimum necessary to lift cuttings; 2) best circulation rate is the one that puts 65 per cent of the horsepower at the bit; 3) circulation rate should be one that gives an optimum bit horsepower if minimum nozzle size is limited; and 4) circulation rates for both two and three will be above the minimum necessary to remove cuttings from the hole.

How Economics Influenced the Design of a 15,000-psi Blowout Preventer. R. C. Brooks and G. E. Nevill. (New York: ASME Paper No. 60-PET-24; 5 pp. $1.00/copy; $0.50 to members.)

Satisfactory design must provide both functional and economical solutions to the users' problems. The design and development of the Cameron-type "F" blowout preventer is cited as an example wherein design features such as balanced pressure forces, removable and interchangeable operators, and use of high-strength alloy steel parts are combined to meet the functional requirements, at the same time satisfying the economic requirement by compactness, reliability, easily removed subassemblies to facilitate shipping, handling and servicing, and by providing maximum latitude in combination or physical arrangement with other equipment.

Laboratory Drilling Performance of the Full-Scale Rock Bit. D. S. Rowley, R. J. Howe and F. H. Deily. *J. Petrol. Tech. 13,* 71 (1961) Jan. (11 pp.)

Authors show how bit weight and rotary speed affect drilling rate with 4¾-in. rock bits under simulated downhole pressure conditions in laboratory tests. Rotary power and effectiveness data also are presented.

Massive 15-Ft. Drill Bit Gets Trial Run. *Petrol. Week 12,* 33 (1961) Jan. 20 (2 pp.)

Manufacturer is conducting tests on a 15-ft drill bit as part of a drive toward adaptation of oilwell equipment to large-diameter drilling. The experimental bit has four conical-shaped, bar construction rolling bits, with approximately 75 replaceable teeth per cone.

Mecom Deep Hole Passes 13,000 Ft. *Petrol. Week 12,* 20 (1961) Feb. 10 (2 pp.)

Halfway mark was reached in early February at John W. Mecom's projected 26,000-ft super-deep test in Palquemines Parish, South Louisiana. As of last report, the hole was being drilled below 13,023 ft. Whether the test—No. 1-S LL&E—is carried to 26,000 ft will depend primarily on what the operator, U.S. Oil of Louisiana, Inc., finds in drilling.

Exploration

Oil Basins Surround the Arctic Ocean. L. Smirnow. *World Oil 152,* 27 (1961) Feb. 1 (6 pp.)

Thick Paleozoic sedimentary sections spotted with reefs, evaporites, diapirs, and salt domes are present in both Free World and Russian portions of the Arctic. Proximity of some of these areas to Western European markets portends a race to develop their oil potential.

Delaware-Val Verde Tests Shoot for New Gas Reserves. R. J. Enright. *Oil Gas J. 59,* 54 (1961) Feb. 13 (3 pp.)

Though operator interest in the West Texas basin's deeper horizons has climbed steadily for several years,

it was fanned to its present flame largely by half a dozen significant and widely separated strikes in 1960. Three big gasfields were brought in last year in sprawling Pecos County in the eastern portion of the Delaware basin.

Shallow Drilling, Large Blocks Prompt Operators to Check Chama Basin. K. Chasteen. *Oil Gas J. 59,* 122 (1961) Jan. 16 (4 pp.)

Large acreage block and possibility of shallow production plus wildcatting spirit have revived exploration and interest in the Chama basin of Rio Arriba County, N. M., and Archuleta County, Colo. One peculiarity confusing to explorers—but which will probably tend to encourage further exploration—is the apparent absence of gas in the portion of the basin east of the Archuleta anticlinorium.

Logging

Flowing Well Logs Can Save You Money. H. L. Bryant. *World Oil 152,* 33 (1961) Feb. 1 (4 pp.)

Flowing well logging operations are used to solve production problems and to evaluate production conditions which exist in dynamic form. Substantial savings in rig time, reduction of production and exploitation expenses, and increased recoveries are some of the benefits already realized from flowing well logs. Early application of flowing well logging operations for evaluation purposes can lead to more efficient production and increased secondary recovery.

How Different Mud Additives Affect R_m-R_{mf}-R_{mc} Ratios. H. M. Johnson. *World Oil 152,* 49 (1961) Feb. 1 (9 pp.)

Term "electric logging" has come to mean a measurement made in a borehole of the electrical properties of the rocks surrounding the borehole. These measurements must be made in uncased hole, for metallic casing provides complete shielding between the measuring electrodes and the formations. However, this is the only material which can completely prevent electrical measurements, for electric logs are now recorded in holes filled with fresh-water muds, concentrated salt-water muds, oil-emulsion muds, or even in empty holes. Resistivity measurements of mud-affected cylinders separating the logging tool from virgin formations must be accurately ascertained if optimum use is to be made of recorded logs.

Modern Well Completion Series. Interpreting Nuclear Logs. B. H. Goode, Jr. *Petrol. Eng. 33* (Drilling and Producing), B-50 (1961) Jan. (5 pp.)

If one use of nuclear radiation logs should be singled out for its contribution toward their present popularity, it would have to be the application of depth correlation. Beside this application, increasing quantitative use of nuclear logging under a wider range of conditions to determine porosity necessitates proper interpretation methods.

Mathematical Methods

Application of Optimizing Techniques for Studying Field Producing Operations. H. D. Attra, W. B. Wise and W. M. Black. *J. Petrol. Tech. 13,* 82 (1961) Jan. (5 pp.)

Article reviews application of this operations research technique to an actual field case and shows how results indicate that the technique 1) can be applied effectively to field problems, 2) can be used to detect unsuspected avenues for improving operations, and 3) can effect a significantly improved means of controlling field operations through the use of the high-speed computer.

Offshore Operations

Automated Offshore Gas Platform. W. A. Hogan. *Petrol. Eng. 33* (Drilling and Producing), B-24 (1961) Feb. (6 pp.)

First automated offshore gas production system that transmits data to shore and records it has completed its first year of operation. The installation operates production equipment on seven gas wells flowing some 6.5 MMCF/day, and is located about 14 miles southwest of Sabine, Texas. The pushbutton system enables a single operator at the onshore station 26 miles away to open and close the seven offshore wells individually, adjust gas volumes produced, check on critical pressures and temperatures, and locate trouble in specific equipment should it develop on the offshore platform.

Total Flow Systems. L. V. Hickman. *Instruments & Control Systems 34,* 71 (1961) Jan. (3 pp.)

Natural gas producer interprets total flow system as an installation where gas is delivered to the pipeline automatically. In one such installation on the Gulf Coast, the thirteen gas-producing wells are in the water. The gas flows through a separate pipeline to land, and then is measured and controlled by a recording flow controller at the point where it is delivered to the pipeline. The measurement here is the total production of all wells; gas from each well also is measured on the peninsula. Article discusses various equipment combinations for obtaining accurate measurements.

Wave Study Pinpoints Platform Needs. *Petrol. Week 12,* 22 (1961) Jan. 20 (2 pp.)

California Research Corp. is well along into the second phase of a wave-action study that has already enabled it to build cheaper and better offshore platforms. First phase helped to cut costs by pointing out where fewer—but usually larger—pilings could be used to support an offshore platform. Since the start of the initial project, more than 20 platforms have been built using knowledge gained from the study.

Reservoir Engineering

What's Ahead in Oil Recovery? P. B. Crawford. *Petrol. Eng. 33* (Drilling and Producing), B-24 (1961) Jan. (6 pp.)

Petroleum reservoir engineering is moving into a new, unproved but exciting era of oil recovery practices, says author. For more than ninety years after the Drake

well primary concern has been in the application of the two basic secondary recovery practices: water flooding and gas injection. Then, in the space of one decade at least ten new recovery methods have been introduced, and about 100 field trials are described in the literature. Management's big decision in the future is to recognize which of the new recovery processes should be applied to a particular reservoir.

Secondary Production

An Economically Successful Miscible-Phase Displacement Project. W. E. Block and R. W. Donovan. *J. Petrol. Tech. 13,* 35 (1961) Jan. (7 pp.)

Slug-type miscible-phase displacement project has been in operation in the 29D pool of the Midway-Sunset field, Kern County, Calif., since March, 1958. This project, as of last year, had resulted in the production of 230,000 bbl of additional oil which can be attributed to propane injection. The project is profitable, and the investment was returned in two years. The pool production rate during April 1960 was 900 bbl/day, which was 540 bbl/day more than the previous gas-injection operation. Reservoir pressure is currently about 1300 psia. The pool now has four injection wells and 12 producing wells, all drilled on 10-acre spacing. To date, a slug of 18 million gallons of propane has been injected.

Secondary Recovery

Where Are We Going with Miscible Displacement? A. B. Dyes. *Petrol. Eng. 33* (Drilling and Producing), B-19 (1961) Feb. (5 pp.)

Petroleum industry is making a major effort to verify miscible displacement as an improved oil recovery process. This effort is at a peak, and between 40-50 projects are in actual field operation. Performance results are beginning to appear, and with these results also comes the question of success or failure. Article gives a general analysis of the various miscible processes and some observations of projects in operation to provide insight into existing obstacles and progress.

Well Practice

Modern Well Completion Series. Part 10A. Permanent-Type, Multiple and Tubingless Completions. T. A. Huber and C. B. Corley, Jr. *Petrol. Eng. 33* (Drilling and Producing), B-32 (1961) Feb. (5 pp.)

Upward trend in finding, developing and producing costs poses a real challenge to the domestic petroleum industry. During the past decade, two of the most important tools for cost reduction have been: 1) development and application of permanent-type well completion methods and associated procedures; and 2) the improvement in equipment and techniques for multiple completions.

Production Operations in Algeria's Hassi Messaoud Field. R. J. Rousseau. *World Oil 152,* 23 (1961) Feb. 1 (4 pp.)

French operators have encountered a number of unusual drilling and producing problems during development of Hassi Messaoud field. To economically resolve these difficulties, which include lost circulation, high-pressure salt water flows, asphaltic tubing deposits, bottom hole sediments, ineffective stimulation treatments and involved workover jobs, the operators are using three rigs to complete a single well; a four-phase mud program on each well; permanent-type well completions; calcium nitrate packer fluid; and an experimental fracturing program.

4. GAS CONDITIONING AND LPG RECOVERY

Carbon Dioxide Removal

Aim: Cleanup in Ammonia. *Chem. Week 88,* 42 (1961) Jan. 28 (2 pp.)

Description of Catacarb process which differs from hot carbonate in a special nonpoisonous catalyst. In an ordinary carbonate process, the concentration of the absorbent, potassium carbonate, is 20-25 per cent. But using the Catacarb catalyst, this concentration can be increased to 40 per cent, and no loss in carrying capacity or activity results. This means that for any amount of absorbent solution that is passed through the absorber column, about one-third more carbon dioxide will be removed.

Gas Purification. W. E. Gifford (assigned to Arthur D. Little, Inc.) U.S. 2,966,037 (1960) Dec. 27.

Apparatus is claimed for removing condensible impurities from gases which uses chilled plates or pebbles as a circulating medium. Such circulating entities are moved downward through a tower, through a heavily chilled zone at the top, and meet the gas which rises near the base of the tower. Impurities such as water, CO_2 and hydrocarbons are condensed onto the pebbles. The clean gas leaves the top of the tower and the coated pebbles leave through the base, the latter to be stripped of impurities and returned to the top of the tower by means of an elevator.

Dehydration

Natural Gas Treatment. R. J. Hull (assigned to Gas Processing, Inc.) U. S. 2,964,915 (1960) Dec. 20.

Process for removal of water and light condensates from natural gas is claimed using a refrigeration system. Raw gas enters at about mid-height of a vertical column and passes upward around a nest of smaller vertical tubes, exchanging heat with the condensate flowing downward inside the tubes. The gas, partly dried, is chilled further by double-refrigerant coils at the top of the column and passes downward through a central downcomer pipe to a lower outlet. The liquid condensates collect in a tray below the coils and are fed down the nest of small vertical tubes where heat exchange and fractionation occurs. Periodic "defrosting" of the top refrigerant coils is practiced to remove hydrates.

Dust Removal

Aerodynamic Capture of Particles. B. B. Morgan. *BCURA Monthly Bull. 24,* 257 (1960) June (4 pp.)

Review outlines the topics discussed at the symposium held under the preceding title at the BCURA research station last year. The subject matter had two main aspects: 1) collision of small particles or drops carried by a fluid stream with a much larger obstacle placed in the stream; and 2) collision of the particles with each other as they are carried along by the fluid owing to the differential effect of gravity or other force.

Mechanical Dust Collectors of Low and Medium Efficiency. R. Jackson. *BCURA Monthly Bull. 24,* 397 (1960) Aug.-Sept. (31 pp.)

Article deals with dust arrestors in which more work is done in separating the particles from the gas, or in which gravity does not play a major role. Many of these arrestors are simple in construction and minimal in cost. Because the controlling dimension may be, for example, the diameter of the stack, they must be specially made to suit each particular installation, manufactured in a large range of sizes. Because of inadequate testing facilities, the amount of data of a scientific nature, such as the grade efficiency of the arrestor, or the variation of overall efficiency with method of operation, is limited. Therefore, the conclusions drawn by the author are largely qualitative and subjective.

Hydrocarbon Removal

"Compact" Gasoline Plants a Hit in Alberta. *Petrol. Week 12,* 18 (1961) Feb. 10 (2 pp.)

Small, package-type gas process plants, custom-tailored where required, are becoming popular in Alberta, Canada. Growing export demand for gas is the impetus for the sudden surge in building. On the basis of the number of such plants already established, plus those either in sight or forecast, Alberta probably will have at least 30 small plants by the end of 1961.

Treatment of Natural Gas in Distribution Systems. R. L. Hasche (assigned to Carbonic Development Corp.) U.S. 2,966,402 (1960) Dec. 27.

Method is claimed for operating a plant for converting high-pressure natural gas from a transmission line to a lower pressure for distribution of such gas to consumers. The high-pressure gas is cooled to condense the ethane and higher hydrocarbons by adiabatic expansion of the gas fraction and heat exchanging it with raw gas. The condensed liquid fraction is stored in an insulated storage vessel at distribution pressure, and may be vaporized and/or reformed to meet peak-load distribution demands.

Largest U.S. Gas-Processing Plant Now in Operation. *Oil Gas J. 59,* 78 (1961) Feb. 13 (2 pp.)

Largest gas-processing cycling plant in the United States, the King Ranch gas plant of Humble Oil & Refining Co., is now in operation. New plant is the focal point of a vast gathering system in which gas is collected through 170 miles of gathering lines from 13 producing fields scattered over a wide area of Southwest Texas. Also tied into the plant is Humble's new 30-in. industrial gas transmission line which parallels the Gulf Coast, 238 miles to the Houston area. Currently the plant is handling 545 MMCF/day of gas, 57 per cent of its design capacity.

Process Chromatograph Controls Deethanizer Operation. J. Zike. *Oil Gas J. 59,* 92 (1961) Feb. 13 (3 pp.)

Instrument described has been controlling the ethane content of a deethanizer bottom product for more than a year. It has exhibited very high reliability and accuracy, and has maintained a maximum propane vapor pressure fluctuation of 7 psi.

Hydrogen Sulfide Removal

Sulfur from Sour Gas for Less Than 1½ Cents Per M.C.F. H. S. Pylant. *Oil Gas J. 59,* 94 (1961) Jan. 23.

Stratford process (see *Gas Abstracts 16,* 253) has been successfully used in three installations to remove H_2S and recover pure sulfur from various gases containing from 10 to 700 grains of H_2S/MCF of gas. Briefly, process consists of washing the gas with a quinone solution, reaction of the H_2S to form sulfur and hydroquinone, oxidation of the hydroquinone back to quinone for reuse, and filtering to remove the free sulfur. Process, economics and equipment are reviewed.

5. NATURAL GAS TRANSMISSION

Communications

Pipeline Communications Data. L. E. Cook. *Pipeline Eng. 33* (Handbook Sect.), H-47 (1961) Feb. (3 pp.)

Engineer has the choice of many types of facilities when preparing estimates or specifications for the communications system of a pipeline. His choice of the type of facility to be used will be influenced by immediate costs, costs over a long period, availability of facilities, reliability of service needed, flexibility of later expansion, and management policies. Article outlines types of systems available and their potential uses.

Compressors

Design Application of Engine-Driven Balanced-Opposed Gas Compressor for Pipeline and Process Installations. W. M. Kauffmann. (New York: ASME Paper No. 60-PET-14; 8 pp. $1.00/copy; $0.50 to members.)

Concept of a power engine-driven compressor unit, to supplement the popular angle gas compressor engine, has gained acceptance in some recent process and pipeline developments. The purpose of paper is to review the design characteristics of unitized drive applications for both two- and four-cycle power engines and explore the relative advantages and disadvantages which accrue with this type of installation.

Compressor Stations

An Automatic Control System for a Gas Pipeline Compressor Station. K. S. Hagius and L. R. Henry. (New York: ASME Paper No. 60-PET-15; 15 pp. $1.00/copy; $0.50 to members.)

Paper is a summary of the engineering studies leading to the decision to adopt automatic control and a review of the principles selected for control of the pipeline system and compressor stations. A description is given, including significant specifications and photographs, of the control system as installed at Springfield Compressor Station and at the Control Center.

The Design of Semi-Permanent Gas Compressor Stations. J. L. Joplin. (New York: ASME Paper No. 60-PET-28; 8 pp. $1.00/copy; $0.50 to members.)

Specifications for semi-permanent units are discussed, with suggestions for proper sizing. Each component required for correct installation is covered.

Pipeline Construction

Longest Flexible Pipeline Project. *Gas World 153,* 112 (1961) Jan. 14.

British Insulated Callender's Cables, Ltd., have received a $7-million contract from the Magna Pipeline Co., Ltd., of Vancouver, British Columbia, Canada, to manufacture, install and commission 53 miles of flexible submarine pipeline to transmit a supply of natural gas from the mainland of British Columbia to Vancouver Island. When completed this installation will constitute the world's longest flexible submarine gas pipeline. It will bring to consumers on Vancouver Island all of the economic advantages of natural gas that now exist on the mainland.

Submarine Pipeline Construction Methods. J. G. Bomba. *Pipeline Eng. 33,* D-23 (1961) Feb. (4 pp.)

Author describes the methods and problems of the Hudson River (New York City) crossing. In May 1959, Transcontinental Gas Pipe Line Corp. was in the middle of a construction program to increase the supply of natural gas to New York City by 35 per cent. Preliminary surveys by Transco's engineers had shown that a site near Manhattan's 72nd Street was the most suitable location for the river crossing. The maximum water-depth found along the 4200-ft crossing was 80 ft, and corings taken along the uniformly sloping bottom had encountered no rock above —105 feet.

Technical Progress in the Construction of Long-Distance Natural Gas Transmission Lines in the Soviet Union. A. K. Kortunow. *Gas- und Wasserfach 101,* 1205 (1960) Nov. 18 (6 pp. German text.)

Author, who is the head of Glavgas, USSR, describes the growth of gas production in his country, and the developments underway in the current seven-year plan. The 37.2 billion cu m produced in 1959 is expected to rise in 150 billion cu m in 1965. Organization of the central bureau and the supply and construction groups is outlined. Research on piping and construction improvement is mentioned, and special treatment is given to welding. Corrosion prevention, new compressor stations and modern machinery are discussed. Pipeline materials and underground storage also are treated.

Pipeline Operations

Computer Simulation of Marine Terminal and Pipeline Operations of the Trans-Arabian Pipe Line Company. D. W. Dreier and B. A. Sachs. (New York: ASME Paper No. 60-PET-20; 8 pp. $1.00/copy; $0.50 to members.)

Paper describes a mathematical simulation model of the Tapline (Trans-Arabian Pipe Line) system. The model, which has been programmed for the IBM 704 computer, will be used in a case-study manner to evaluate possible investments in physical facilities and to measure the incentives for revising operating practices or procedures. Elements of the model representing the four pipeline sections and associated pumping stations and tankage, and the tankage and shiploading facilities of the Sidon Terminal are explained. Several case studies, made under representative conditions derived from 1958 data, and an example of use of the model for facilities evaluation are discussed.

Piping

Working Pressures for Gas Piping (Based on ASA Code B 31.8-1958). *Pipeline Eng. 33* (Handbook Sect.), H-1 (1961) Feb. (11 pp.)

Tables give as basic information the nominal size, outside diameter, weight per foot, wall thickness and mill test pressure as specified in the standard of the pipe under consideration. Working pressures, as defined in Par. 841.14 (b) of the ASA Code B 31.8-1958, shall not exceed 85 per cent of the mill test pressure, unless a higher hydrostatic test pressure is placed on the pipe either before or after installation. To operate at these higher working pressures, the code requires that the pipe be retested hydrostatically either before or after installation, or that a higher than standard mill test pressure be specified when ordering.

Transportation

New Project Opening Houston Channel to Bigger Tanks. H. M. Wilson. *Oil Gas J. 59,* 50 (1961) Jan. 23 (2 pp.)

Houston ship channel—home of six major refineries and a host of oil terminals and chemical plants—has just finished one big widening and deepening project and has started another. Bids have already been submitted on a $2.5-million curve-easing job in the Baytown area. When the full $19-million project is completed, the channel will be straighter, 4 feet deeper most of the way, and 50 feet wider in its middle section.

Welding

Double-Jointing Came Long Way in '60 . . . and Greater Progress Foreseen for '61. P. Reed. *Oil Gas J. 59,* 70 (1961) Feb. 13 (4 pp.)

Equipment changes in portable field plants using automatic welding for double jointing are greatly increasing

their effectiveness. Advantages of the newer basic designs for fullest use of automatic welding were demonstrated in 1960 when 750 miles of double-jointed pipe were used on the Transwestern system and lesser amounts on other large projects. In 1961 double jointing promises to be still more important because it has been specified for the 1400-mile trunk line to transmit gas from Alberta to San Francisco for Pacific Gas & Electric Co.

New Look at Stress Relieving Field Welds. W. J. Keough. *Petrol. Refiner 40,* 139 (1961) Jan. (4 pp.)

Commercial stress-relieving equipment for field welds may not be readily available. Article describes a unique method of designing electrical resistance heating elements for use with welding machines and temperature recorders. Method will assure good temperature control and accurate stress relief in the weld area.

6. GAS AND LPG STORAGE

Gas Holders

Saint-Aubin-sur-Mer Spherical Gasholder. J. Bienvenu and S. Lecointe. *J. Ind. du Gaz 84,* 514 (1960) Dec. (5 pp French text.)

Recently a spherical gas holder was put into operation at Saint-Aubin-sur-Mer. It has a capacity of 3000 cu m under a pressure of 4 hpz, which allows 12,000 cu m of gas to be stored. Article gives a description of the various operations, their control and also the auxiliary devices used.

LPG

Minnegasco Plans Biggest Refrigerated Storage Tank. *Am. Gas J. 188,* 28 (1961) Feb.

World's largest tank for propane storage, 120,000-bbl capacity at —50°F, will be the heart of a giant new refrigerated facility for liquefied gas designed to nearly double the present propane capacity of Minneapolis Gas Co. The other portion of the double wall tank will be 106 ft in diameter and more than 100 ft high. This outer steel shell—combined with 30-in. of insulating material—will form a vapor-tight barrier to the inner vessel, which will be fabricated of a special code-approved steel.

The Proper Method of Unloading LPG Tank Cars. *Butane-Propane News 23,* 44 (1961) Feb. (4 pp.)

Procedure guide describes connection fittings (all of which are made through the dome cover plate on the top of the LPG tank car), preparations for unloading, unloading by compressor and loading by pump. Schematic drawing of LPG tank car dome fittings is included.

Methane Liquefaction

Liquid Methane May Warm East Coast on Coldest Days. G. T. Kinney. *Oil Gas J. 59,* 90 (1961) Jan. 30 (2 pp.)

Announcement of a liquefied natural gas (LNG) plant for meeting peak-day demands on the U. S. East Coast may be made before the year is over. Planning is active on several fronts: a consulting engineer report backing up the technical and economic feasibility of LNG has been given to a group of New England utilities; several East Coast utilities and the transmission companies which supply them are studying LNG as a possibility for their own peak shaving needs; and research into the best means of storing LNG is being pushed by the A.G.A.

Method and Apparatus for Storing Liquefied Gases. H. L. Stowers (assigned to Texas Gas Transmission Corp.) U. S. 2,963,873 (1960) Dec. 13.

In a storage tank for low-temperature liquids such as liquefied methane (—258°F), an improved double-tank system is claimed. This consists of an inner metal tank, contracting or expanding with changes of temperature, and an outer tank, with a layer of insulating material in the intervening annulus. As the inner tank is filled, the walls are chilled by a spray, and a second liquid, such as butane, pentane, *iso*pentane (or their mixtures), is pumped into the annular space. These liquids freeze solid and act to support the cold inner granular insulation.

Tank for the Storage and Transportation of a Low Boiling Liquid. J. J. Henry (assigned to Conch International Methane Ltd.) U. S. 2,966,040 (1960) Dec. 27.

Storage tank for large volumes of low-boiling liquefied gas (methane) is claimed in which special sprays and vents are connected to cool the walls of a warmed tank. The sprays are fed with small amounts of liquid methane until the walls are cooled below the point of rapid evaporation, the vaporized gas being returned to the liquefier cycle. After so cooling, liquid methane can than be allowed to enter the tank through the usual large inlet.

Underground Storage

How Northern Natural Operates Aquifer Gas Storage. *Oil Gas J. 59,* 116 (1961) Feb. 6 (2 pp.)

Brief description is given of Northern Natural Gas Company's aquifer operations near Redfield, Iowa. The company is now taking 100 MMCF/day from these reservoirs, and expects within three years to increase the withdrawal rate to about 300 MMCF/day. The reservoirs have been developed in two sandstone formations, the St. Peter and the Mount Simon. The former, 1736 ft below ground level at its crest, is 37-ft thick and was developed first. The Mount Simon, which crests at 2647 ft below ground level, has an average thickness of 115 ft. Two adsorber vessels are connected with the St. Peter withdrawal line and two with the Mount Simon line. Each vessel contains 37 tons of bauxite desiccant. The interior of each vessel is checked annually.

Underground Storage of LPG at Antwerp. P. Dorzee. *J. Ind. du Gaz 84,* 511 (1960) Dec. (3 pp. French text.)

Excerpts are presented from the author's paper delivered at the last International Hydrocarbon Congress of Pia-

cenza. Several important technical and economic aspects of underground storage of LPG at Antwerp are discussed, including the methods used to achieve them.

7. MANUFACTURED GAS AND CHEMICAL PROCESSING

Ammonia

Recovering Ammonia from Ammonia-Water Vapors. M. C. Fields. *Ind. Eng. Chem. 53,* 131 (1961) Feb. (6 pp.)

Several proposed cyclic regenerative processes for recovering ammonia from a gas stream involve an ammonia-water vapor of atmospheric pressure as a necessary intermediate to a final anhydrous-ammonia product. Ordinarily, the anhydrous ammonia must be produced in a high-pressure column. The fractionation of the vapor feeds, initially at a pressure of one atmosphere, in a high-pressure column is complicated by the desire to utilize as much as possible of the latent heat already contained by the vapor, but at the same time to avoid high vapor compression costs. Several alternate methods for processing these vapors are presented along with the utility requirements for each.

Aromatics

Maybe Aromatics Production Is Your Dish. L. D. Stewart, R. A. Lush and J. H. Miller. *Oil Gas J. 59,* 110 (1961) Feb. 6 (4 pp.)

Refiners are becoming increasingly aware of the possibilities of applying conventional oil refinery processing methods to the production of petrochemicals. DX Sunray diverted excess capacity of a new catalytic reformer to aromatics production. Total investment, including Udex extraction unit, was $2,000,000. The calculated payout is under two years. Description of company's aromatics operation at the Tulsa refinery can serve as a guide for other refiners that may be interested in upgrading their products for the chemical market.

Carbonization

Focus on the Coking Industry. *Gas World 153* (Coking Sect.) 2 (1961) Jan. 7 (5 pp.)

Recent addresses delivered to the Coke Oven Managers' Association deal with retrospect and prospects of the coking industry. Article attempts to weigh the significance of the assessments, considers some of the activities within the British coking industry during the past year, and suggests tentative draft resolutions.

Carbon Monoxide

The Effect of Sulphur Dioxide on the Combustion of Some Inorganic Compounds. Part 1.—The Carbon Monoxide + Sulphur Dioxide + Oxygen System. C. F. H. Tipper and R. K. Williams. *Trans. Faraday Soc. 56,* 1805 (1960) Dec. (7 pp.)

Effect of sulfur dioxide on the combustion of carbon monoxide in a static system was investigated using a boric-acid-coated vessel. Added water was usually present. The lower explosion limit was not affected, but the tip of the explosion peninsular and the upper limits were shifted to higher temperatures by the addition of small amounts of SO_2, which also markedly reduced the rate of slow oxidation above the upper limit. Replacement of nitrogen in a $2:1:1CO+O_2+N_2$ mixture by the same amount of carbon monoxide or oxygen increased the oxidation rate slightly in the absence of, but greatly in the presence of, sulfur dioxide. Packing the vessel considerably reduced the rate. Analysis showed that there was little overall loss of sulfur dioxide.

Coal

A Short History of Pulverized-Fuel Firing. R. H. Essenhigh. *J. Inst. Fuel 34,* 16 (1961) Jan. (11 pp.)

Pulverized-fuel firing has a history of commercial exploitation going back 75 years, but its origins go back to the beginning of the last century at least. The real beginnings of commercial exploitation began in 1895 with the application of pulverized-fuel firing to cement kilns. In the next 25 years, it became unrivaled in the cement industry, and it also had extensive application in the metallurgical industry. From the early 1920's onward, however, these applications were completely overshadowed by the development of pulverized-firing of water-tube boilers, and steam raising today is the chief objective of pulverized-firing application.

The Cyclone Furnace. A. G. Roberts. *BCURA Monthly Bull. 24,* 205 (1960) Apr.-May (54 pp.)

Present review is concerned with cyclone firing information published since 1954. During this period, cyclone-fired boilers in Great Britain and other countries have been commissioned. It has become apparent that considerable interest has been and is being shown in the USSR, and much interesting work has been carried out there regarding the more fundamental aspects of cyclone operation. Language difficulties prevent a comprehensive review of this work, but references to it are made where appropriate. Bibliography cites 221 references.

The Influence of Functional Oxygen-Containing Groups on the Apparent Internal Surface of Coals. I. G. C. Dryden. *BCURA Monthly Bull. 24,* 289 (1960) July (8 pp.)

Confusion still persists in some of the more general statements made or quoted from time to time about internal surface and heat of wetting. Review attempts to assemble salient facts, examine them critically and place the subject in perspective. It is convenient at the same time to consider the relation between internal surface and the content of oxygen-containing groups, since the experimental observations are influenced by both. No attempt is made to review either topic comprehensively.

The Influence of Volatile Matter on the Combustion of Pulverized Coal. J. F. Mullen and G. Gould. (New York: ASME Paper No. 60-FU-3; 4 pp. $1.00/copy; $0.50 to members.)

Authors indicate an approach and present an hypothesis concerning the influence of volatile matter in the combustion of pulverized coal. The complexity of the combustion problem raises numerous questions for which answers are essential before a comprehensive understanding of the phenomena involved can be given. The hypothesis presented, although in somewhat simplified form, has helped to explain some of the more common phenomena. The authors conclude that if sufficient questions are asked and suitable answers developed, the purpose of the paper will have been realized.

Studies on the Interaction of Oxygen with Coal in the Temperature Range 0° to 90°C, Part 1. P. G. Sevenster. *Fuel 40,* 7 (1961) Jan. (11 pp.)

Oxygen adsorption characteristics of some South African coals have been determined. Chemisorption is evident from about 0°C upwards. Analysis of the gaseous reaction products indicates formation of carbon monoxide, carbon dioxide and water at 42°C and higher. The heat of adsorption, measured by means of isothermal calorimeters, is about 65 kcal/mole and is independent of the amount adsorbed.

Studies on the Interaction of Oxygen with Coal in the Temperature Range 0° to 90°C, Part 2. Consideration of the Kinetics of the Process. P. G. Sevenster. *Fuel 40,* 18 (1961) Jan. (15 pp.)

Rate of oxygen chemisorption by some South African coals can be represented by the Elovich equation in the early stages of the process. During the later stages the rate is determined by the parabolic diffusion law. In the intermediate stages the kinetics are complicated by chemisorption, adsorption and various types of diffusion.

Urban Central Heating Plant Controls Smoke, Dust, Noise Automatically. *Heating, Piping & Air Conditioning 33,* 113 (1961) Feb. (4 pp.)

New coal-fired heating plant which serves the various buildings of Northwestern University's Chicago campus is located within an elite residential district, yet the surrounding neighborhood is unoffended by sight, smell or touch. Coal proved to be the most economical fuel for the particular needs of the campus, and extensive design features eliminated the possibility of noise and air pollution nuisance. All fueling, combustion and ash disposal operations are carried on within a single dust-tight building, identifiable only by its lack of windows and a tall rectangular enclosure for the smokestacks. Completely automatic operations carry the coal from truck to boiler and back to trucks as ashes. The plant has an annual production of 300 million pounds of steam.

Coal Gasification

Apparatus for Gasification of Solid Materials. S. W. Walker (assigned to Pan American Petroleum Corp.) U.S. 2,965,461 (1960) Dec. 20.

Apparatus for gasification of any solid carbonaceous fuel is claimed. Pulverized coal is injected in steam suspension into a front horizontal combustion chamber, and meets a separate oxygen stream to form a shower of gasifying particles and slag. The slag collects on the floor and on a sloped back wall of the chamber which serves as a gas outlet passage.

Development and Operation of a Pilot Plant for Feeding Bituminous Coal Slurry to a Pressure Gasifier. W. R. Huff and L. F. Willmott. *U. S. Bur. Mines Rep. Invest. 5719,* (Washington, D. C.: U. S. Dept. of the Interior, 1961; 36 pp.)

Report describes development and operation of a pilot plant designed for using high-volatile A bituminous coal-in-water suspensions as a source of preheated coal and superheated steam in the pressure gasification of coal with oxygen. Work included: 1) development of equipment and methods both for mixing pulverized coal and water to produce slurry and for pumping and metering the slurry at gasification pressure; 2) development of equipment for heating the flowing slurry; and 3) demonstration of the process under actual gasifier conditions.

Gasification of Solid Carbonaceous Fuels. F. W. Luerssen (assigned to Inland Steel Co.) U.S. 2,962,367 (1960) Nov. 29.

Coal gasification process is claimed in which two streams of 100-mesh coal are suspended in O_2-rich gas and injected into a refractory reaction zone so as to impinge with high turbulence. The oxygen supply is adjustable to form one completely combusted high-temperature flame and one incompletely reacted flame. The high flame yields sufficient energy to react a major part of the CO_2 with carbon.

Regeneration Heat Exchange Process for Formulation of Combustible Gas. D. E. Elliott (assigned to Power Jets Ltd.) U.S. 2,965,463 (1960) Dec. 20.

Process is claimed for use of a regenerative heat exchange apparatus in a gas production method. The improvement comprises building up a heavy layer of hot slag by centrifugal force on the inside of a rotating cylinder. This may be formed by ash, dust and slag from coal, and the hot inner surface may be liquid. Pulverized fuel and oxygen may be used to build up the layer. This layer is then used to heat and react a gas stream along the central axis and must then be reheated.

Scottish Lurgi Plant Goes into Production. *Gas World 153,* 90 (1961) Jan. 7.

Scottish Gas Board has announced that the new high-pressure gasification plant at Westfield, Fife, went into production on December 27. Small quantities of gas are being passed into the supergrid and distributed to customers in Cardenden, Cowdenbeath, Kelty, Kinross and Lochgelly, and to the Glasgow area. Current production is of the order of 6 MMCF/day. The output will gradually be increased until it reaches 15 MMCF/day sometime in February.

Slagging Fixed-Bed Pressure Gasification Pilot Plant. W. H. Oppelt. *Gas Age 127,* 34 (1961) Feb. 2 (3 pp.)

Author discusses a Bureau of Mines pilot plant testing the feasibility of the gasification of lignite. The use of

a modified Lurgi fixed-bed gasification process appears to offer a more efficient and practical method of gasification under slagging conditions.

Distillation

Batch Distillation of Binary Mixtures Provides Versatile Process Operations. B. Block. *Chem. Eng. 68,* 87 (1961) Feb. 6 (12 pp.)

Even with modern handling and process techniques, the batch unit still plays a very important part in industrial chemical operations. It is still the most economical means of separating pure components from multicomponent mixtures. Author considers theoretical and practical aspects of the batch distillation unit.

Mathematical Methods

Numerical Mathematics for Chemical Engineers. D. L. Whitley. *Chem. Eng. 68,* 101 (1961) Feb. 6 (6 pp.)

Numerical math offers significant advantages over analytical methods, says author. For example, if it is necessary to integrate a function whose integrand does not appear in a table of integrals, a solution by the analytical method is impossible. With numerical math, however, using a method such as Simpson's rule where values are obtained by substitution, a solution is possible. Article illustrates the application of numerical math techniques. Those recommended by author have been programmed and used on a digital computer.

Oil Gas

Oil Gasification at Thetford. M. F. Hull. *Gas World 152,* 922 (1960) Dec. 24 (3 pp.)

Catalytic oil gas plant which serves both Thetford and Brandon (England) is described first historically and then functionally.

Ore Reduction

Blast Furnace Enrichment Investigations. E. J. Ostrowski, G. Kesler and N. B. Melcher. *J. Metals 13,* 25 (1961) Jan. (6 pp.)

Results of investigations carried out in the U.S. Bureau of Mines' experimental blast furnace at Bruceton, Pa., are reported. The effect of moisture, natural gas and oxygen injection are described.

Blast Furnace Injections. J. A. Cordier. *J. Metals 13,* 31 (1961) Jan. (6 pp.)

Calculation methods are described which give the conditions to be fulfilled in order to tap the same quality of iron and have a smooth running furnace when a new material is injected into the blast. These calculations also show the effects of the injection upon the regularity of the iron, the production of the furnace, the coke rate, and the quality of gas produced. Included in the article are the results of two industrial campaigns: one with natural gas and the other with light fueloil.

Coke-Oven Gas Injection. E. R. Dean and R. A. Powell. *J. Metals 13,* 49 (1961) Jan. (2 pp.)

Tests showed that coke-oven gas, containing hydrogen sulfide, could be injected successfully into the tuyeres of a merchant iron blast furnace. Increased metal production and decreased coke consumption resulted; hence, the practice of gas injection was adopted on a production basis.

Furnace Apparatus for the Reduction of Metallic Ores. M. E. Rouaux. U.S. 2,964,309 (1960) Dec. 13.

Sloped, rotary cylindrical furnace for gaseous reduction of ore is claimed, with an upper extension for roasting ore with air and a lower extension for receiving hydrogen or other reducing gas. The lower portion of the cylinder is surrounded by an insulating jacket which carries air to be preheated. The air is passed into the upper roasting extension. Reducing gas may be piped in or may be generated in attached equipment.

Petrochemicals

Oxidation Processes in the Petrochemical Industry. Part 1. Vapor-Phase Processes. P. W. Sherwood. *Petro/Chem Eng. 33,* C-10 (1961) Feb. (6 pp.)

In the manufacture of petrochemical intermediates—as distinct from end use chemicals—more than 80 percent of production involves the use of two related chemical reactions: oxidation and dehydrogenation. On a volume basis, dehydrogenation is the more important. But in point of versatility, oxidation is in a class by itself. A recent analysis shows that processes of this type are involved in the manufacture of 48 out of the 70 top petrochemicals produced in 1960. Fundamentally, oxidation processes may serve four different purposes: addition; substitution; dehydrogenation; and thermal effect.

Phenols

Biological Oxidation of Phenolic Waste Liquor. G. F. G. Clough. *Chem. & Process Eng. 42,* 11 (1961) Jan. (4 pp.)

There are many chemical processes which give rise to phenolic effluent. In the past these effluents have frequently been allowed to flow into the nearest watercourse, thereby giving rise to pollution. Article describes a plant designed for the oxidation of phenolic waste liquor from an ammonia still, particularly stressing the economics of the problem. Any effluent amenable to bacteriological oxidation can be treated by a similar process provided optimum conditions are first determined in the laboratory.

Tar

The Composition of a Lurgi Brown Coal Tar. III. The Neutral Oil Fractions Boiling From 30 to 130° C and 130 to 172° C. I. Brown. *Australian J. Appl. Sci. 2,* 403 (1960) Dec. (31 pp.)

The composition has been determined of two neutral oil fractions of a Lurgi brown coal tar from the plant

of The Gas and Fuel Corporation of Victoria at Morwell. The two neutral oil fractions were separated from the tar as described in Part I of this series (Brown 1959). Fraction N/I which had a boiling range from 30° to 130° C amounted to 13.03 wt. % of the tar and fraction N/II with a boiling range from 130° to 172° C, was 12.69 wt. % of the tar. These fractions were first separated as liquids by displacement chromatography on silica gel. Neutral oil fraction N/I was found to contain aromatics (78 wt. %), olefins (10%), paraffins (5%), and non-hydrocarbons (7%); neutral oil fraction N/II contained aromatics (67%), olefins (15%), paraffins (7%), and non-carbons (11%).

Water

Saline Water Conversion by Freezing with Hydrocarbons. G. Karnofsky. *Chem. Eng. Progress 57,* 42 (1961) Jan. (5 pp.)

Successful experimental work in crystal growing and washing to remove occluded mother liquor with minimum loss of product water shows potential of direct freezing process using butane. Low plant investment cost is promised by elimination of indirect heat transfer surface, and by availability of large, efficient compressors.

Water Gas

Some Experiences with P.F.D. on C.W.G. Plant. G. Waite. *Gas World 152,* 950 (1960) Dec. 31 (3 pp.); *Gas J. 305,* 17 (1961) Jan. 4 (6 pp.)

Essentially a practical paper, emphasis has been placed on the cause, introduction and effect of "primary flash distillate" in C.W.G. plants and not on technical survey and comparison of "blue water gas" efficiency. Since vesting day, the gradual increase in the cost of feedstock for C.W.G. manufacture has caused concern as to the probable future of this type of plant. Its use generally had been limited to peak load output, but the trend on the coke market, allied with the concentration of gas load on fewer, but larger, works necessitated a heavier C.W.G. load.

8. GAS DISTRIBUTION

Changeover

Operation Natural Gas. D. L. Turley. *Am. Gas J. 187,* 26 (1961) Feb. (3 pp.)

On August 6, 1960, Boston Gas Company turned natural gas into its central district distribution system, putting the company's entire system on natural gas. This date marked the end of a 4½-month appliance adjustment project costing $2,500,000. Some 680,000 appliances were adjusted. The change to straight natural gas of 1045 Btu content from a 900 Btu mixed gas also served to increase system capacity by 16 per cent.

Customer Service

Standardized Truck Loading. *Am. Gas J. 188,* 18 (1961) Jan. (6 pp.)

Southern Counties Gas Company's standardized service truck loading technique makes it easier for a field man to work with any truck to which he is assigned. In addition to increasing efficiency, it keeps the amount of material carried on trucks within a reasonable limit. Article describes program.

Distribution Systems

Improving the Electronic Grid Computer. F. R. de Brem. *J. Ind. du Gaz 84,* 522 (1960) Dec. (French text.)

Brief description of the procedure used to modify an electronic grid computer, used for the automatic control of flow rates. Operational changes have introduced the need for modification, and this is accomplished by successive approximations.

Natural Gas Comes to Virginia Beach. J. F. Ring. *Gas Age 127,* 23 (1961) Feb. 2 (2 pp.)

Author reports on the transition to natural gas in Virginia Beach, Va., and describes how an all-copper distribution system was adapted to the change in pressure involved in the switch from 2520 Btu propane to natural gas.

Metering

A Look at Rotary Meter Operations. W. J. Taylor. *Gas Age 127,* 25 (1961) Feb. 2 (6 pp.)

Discussion of rotary meter operations at Michigan Consolidated Gas Company. Author covers five major points: the how, where and why mechanics of installation, testing, and maintenance. Reasons for company's decision to use the rotary meter are physical size, pressure rating, cost, change period, and accuracy. These factors are discussed.

Rotary P.D. Meters Will Work in the Oil Field. R. B. Symon. *Oil Gas J. 59,* 82 (1961) Feb. 13 (3 pp.)

On May 21, 1958, a 4 by 8-in., 125-psi working pressure rotary positive-displacement gas meter was placed in well test service by Shell Oil Co. at an offshore Louisiana location. Up to the present time, application for this type of meter in the United States has been almost exclusively by utility and large industrial concerns. As a result of this installation and other evaluations, it is now believed that this meter is well-suited for oilfield service.

The Quick Change Orifice Cap. H. R. Heath. *Am. Gas J. 188,* 24 (1961) Jan. (2 pp.)

New device, developed by Mountain Fuel Supply Co., helps speed testing of large meters. Simple in design and operation, device is a cap that houses the orifice plate, slides on the outlet end of Victaulic connected meters, and snaps into place. With this new device, dubbed a "quick change orifice cap," company can test a meter in the same time formerly required to make the initial hookup using the old coupling.

9. GAS FUEL UTILIZATION AND APPLIANCES

Air Conditioning

How Chicago's New Exposition Hall Is Heated and Air Conditioned. McCormick Place. P. M. Derrig and L. R. Flook. *Heating, Piping & Air Conditioning 33,* 95 (1961) Feb. (5 pp.)

Year round air conditioning for the big new exposition palaces being constructed in various cities is a many-sided design problem. Generally, the first consideration is one of size and of multipurpose, since most of these halls can handle several kinds of expositions, meetings and banquets simultaneously. Large open areas, extreme floor-to-ceiling heights, maximum access space between areas and to the outside, and provision for all of the various service areas further complicate the problem. Specific problems of Chicago's newest convention hall, McCormick Place, are discussed.

Air Pollution

A Progress Report on the Photochemistry of Polluted Atmospheres. E. A. Schuck, G. J. Doyle and N. Endow. (Report No. 31, Air Pollution Foundation, San Marino, Calif.) 1960 (Dec.) 112 pp.

Report is fourth in series describing work done by the Stanford Research Institute in the smog chamber at its Southern California Laboratories. The deleterious effects of photochemical interaction of atmospheric pollutants are now recognized as a growing problem in most U.S. urban areas. Major portion of the pollutants responsible for this problem is emitted to the atmosphere in the exhausts from 70 million automobiles. Assuming that proposed remedial devices reduce the olefin content of the exhaust to almost zero, one can envision conditions wherein eye irritations would be reduced more than 50 per cent, visibility increased only slightly, and ozone values reduced not at all. In addition, the chemistry of the effluent from automobiles with attached control devices is not known. Therefore, overall objective of research program is to understand the reactions involved in photochemical smog.

Techniques Employed in a Study of the Properties of Flue Gases from Large Oil-Fired Boilers. J. Stein, B. G. S. Taylor and G. R. Wade. *J. Inst. Fuel 34,* 8 (1961) Jan. (11 pp.)

Objective of program was to establish reliable technique for the evaluation of plant-scale tests in large oil-fired power station boilers. The equipment and instrumentation developed for the measurement of metal corrosion, SO_2 and SO_3 content of the flue gas, and the flue-gas solids burden, enable a rapid assessment of the boiler performance to be made. The corrosion probe described is of light weight construction, and the whole assembly is portable. Its design makes it possible to carry out measurements at two temperature levels during one exposure, and a complete corrosion profile may be obtained in two working days. By employing an automatic analyzer for the determination of SO_3, much better accuracy was obtained than with conventional manual methods.

Burners

Gas Burner Construction. C. W. Arnott, S. F. Jackes and R. H. Sheets (assigned to Jackes-Evans Mfg. Co.) U.S. 2,965,165 (1960) Dec. 20.

Improved gas burner for space heaters is claimed which is comprised of parts stamped from thin sheet metal. The form consists of the mixing chamber with a Venturi tube leading to the primary chamber, and communication slots to a secondary chamber with the latter feeding the radially-firing burner ports.

Gas Burner Structure. B. Spieth and C. W. Nesbitt (assigned to Modine Manufacturing Co.) U.S. 2,963,083 (1960) Dec. 6.

Improved burner structure is claimed, in which gas is burned in a vertical-flue assembly and air to be warmed is blown crosswise between the tapered flues. The upper and lower ends of the flues are locked into tube sheets, the lower forming part of the burner chamber, and the upper forming part of the ventilating system. The flues are formed from two stampings of sheet metal.

Flame Deflectors. J. T. Alger (assigned to Configured Tube Products Co.) U.S. 2,965,166 (1960) Dec. 20.

Gas burner is claimed in which the improvement comprises a deflector for directing and shaping the flame. The deflector is formed from sheet metal with a front cylindrical shape to fit into the burner mixing tube, and a U-shaped rear portion with an upward-opening slot as a flame port.

Furnaces

Fast Heating Accomplishes Uniform Spheroidizing of Heading Stock. J. Tschopp. *Ind. Gas 39* (Amer.), 2 (1961) Jan. (2 pp.)

Continuous pusher-type furnace consistently produces better than 85 per cent spheroidizing of pearlite in structure of alloy steels for headed products. Furnace is heated by suction-type radiant tubes and is designed for flexible operation. Gas-tight in construction, this type furnace can be used for annealing on a number of heating and cooling cycles, with or without protective or reactive atmospheres. The furnace can also be used for carbonitriding, carburizing, carbon recovery and normalizing.

Industrial Heating

Bright Annealing Stainless Tubing in Twin Muffle Furnace. *Ind. Heating 28,* 64 (1961) Jan. (4 pp.)

Gas-fired atmosphere controlled furnace of new design is being used at Trent Tube Co., East Troy, Wis., to bright anneal stainless tubing. Furnace is underfired on each side by 18 nozzle mixing burners. With this design, the burners fire into the combustion space below the work area. Products of combustion completely envelop

the muffles before being exhausted through the overhead duct work. Maximum production control and uniform heat distribution are assured.

Britannia's Rule — Buy Gas. E. Ford. *Gas J. 305* (Gas in Ind. Sect.), 8 (1961) Jan. 4 (5 pp.)

Britannia Iron and Steel Works Ltd. consume upwards of 120 MMCF/yr of town gas in a wide variety of applications. The supply and service for this load are provided by the Bedford District, Cambridge Division, Eastern Gas Board. Heat is required in the manufacture of the castings, including such important processes as core drying, foundry work, annealing, heat galvanizing baths and casting rectification. Author tells how malleable iron tube fittings are manufactured with the help of gas.

Furnaces for High Temperature Carburizing. Part 3. W. H. Holcroft. *Ind. Heating 28,* 40 (1961) Jan. (9 pp.)

In previous article (see *Gas Abstracts 16,* 211), author stated that he does not anticipate much if any commercial carburizing at temperatures above 1850°F. There are several reasons for this. Grain growth may or may not be one of these reasons. The increased hydrocarbon required with increasing temperature and the tendency of thermal breakdown of the hydrocarbon to increase with increasing temperature means heavy soot deposit which adversely affects the final stage control. Furnaces discussed in this article include rotary, roller hearth, conveyor chain, batch-type, and pusher-type.

Gas Keeps Them Flying. K. G. Eccleshare and C. H. Hirst. *Gas J. 305* (Gas in Ind. Sect.), 18 (1961) Jan. 4 (5 pp.)

Aircraft and allied industries occupy a leading place in manpower requirements in the Southwest (Great Britain), and their status with regard to gas consumption is rather similar. Of the South Western Gas Board's total industrial gas load, this industry accounts for approximately 10 per cent. Article outlines some of the developments which have shown enterprise and which have enabled the Board to identify themselves to some extent with the aircraft industry's vast programs of research and development.

Lime-Recovery Kiln Reduces Costs, Eliminates Waste-Disposal Problem. H. R. Rohr. *Ind. Gas 39* (Amer.), 10 (1961) Jan. (2 pp.)

Operating around the clock, seven days a week, huge gas-fired kiln, which is 11 feet in diameter and turns at the rate of two-thirds of a revolution per minute, is currently producing about 120 tons of calcium oxide per day. Its ultimate lime-recovery capacity is 200 tons/day. The ratio of recovered lime to sludge input is somewhat better than ninety percent.

Methane and the Crucible Melting of Nonferrous Metals. P. Brunel. *J. Ind. du Gaz 84,* 519 (1960) Dec. (3 pp. French text.)

Resume of a report given by the author at the "Centre d'Information du Gaz Natural de Lyon," which develops the reasons for changing a foundry crucible for application to natural gas. Technical and economic considerations are included.

Refrigeration

Refrigerating Apparatus Including Supplemental Refrigerating Means. J. Roeder, Jr. (assigned to Whirlpool Corp.) U.S. 2,964,912 (1960) Dec. 20.

Refrigerating apparatus is claimed which comprises a refrigerated enclosure in combination with a supplemental refrigerated chamber. The latter smaller chamber is cooled by thermoelectric units mounted to form a panel. These units are designed to extract heat from the chamber and dissipate it into the larger refrigerating enclosure by application of an electric current.

Space Heating

Winter Changeover — Yes! J. Lee. *Gas Heat and Comfort Cooling 12,* 40 (1961) Jan. (5 pp.)

Heating installation is a time-consuming job during any season; in winter time makes a difference in business. Until recently the entire house would cool down during changeover, and consequently many customers avoided winter installation. Now new techniques and careful planning can make heating installation a one-day operation. Author tells how to build winter heating business.

Water Heaters

Water Heating Apparatus. E. S. Collinson (assigned to Lucas-Rotax Ltd.) U.S. 2,965,079 (1960) Dec. 20.

Gas-fired water-heating apparatus is claimed which comprises a vertical central water reservoir, heated by an internal submerged pulsatory combustion chamber. The pulsating gas and air valves are mounted on a partition between the upper air and the middle water chambers. Combustion gases are forced through multiple small tubing coils outside the combustion chamber to a collection space below, from which they are vented.

10. EQUIPMENT AND INSTRUMENTATION

Automation

Process Control and Automation. T. J. Williams. *Ind. Eng. Chem. 53,* 166 (1961) Feb. (3 pp.)

Review and its companion expanded bibliography (110 references cited) covers the periods December 1, 1959 to November 30, 1960 for domestic publications, and October 1, 1959 to September 30, 1960 for foreign publications. Complete bibliography for the 1959-60 Fundamentals Review of Process Control and Automation by the author is available for one dollar.

Power Units for Plant Mechanization and Automation. Part 2. L. Walter. *Coke and Gas 23,* 33 (1961) Jan. (6 pp.)

Author continues his discussion (see *Gas Abstracts 17,* 19) by describing a closing device for the Wolff self-sealing oven door, pneumatic actuation of skip doors, the A.E.I. Thrustor, hydraulic remote control, control instrumentation and system maintenance.

Computers

How a Computer Helps Atlantic Get the Most Out of Butane. J. R. Aicher, P. D. Birkhahn and H. C. Lester, Jr. *Oil Gas J. 59,* 72 (1961) Jan. 16 (4 pp.)

Company has developed a program for handling refinery butanes. It includes the effects of process variables, inventories, and gasoline specifications on butane excesses and requirements and alkylate production. It can be used to size new equipment, improve operating efficiency, evaluate refinery operation and take a closer look at capital expenses.

Gas Turbines

For the Hydrocarbon Process Industry . . . How to Specify Gas Fired Turbines. B. L. Short. *Petro/Chem 33,* C-23 (1961) Feb. (4 pp.)

National Electrical Manufacturers Association specification exists for gas turbines, but it is primarily for the power industry and is limited mainly to definition of terms. The absence of any recognized code or standard covering the specification and installation of gas-fired turbines for HPI makes it imperative that the design engineer take a careful look at his requirements in order to specify properly. Article discusses important features for gas turbine installations and offers a suggested form for recording design requirements.

Gas Turbine Application, in HPI. D. F. Bruce. *Petrol/Chem 33,* C-19 (1961) Feb. (4 pp.)

Economy of installation and competitive operating costs for gas turbine power plants have established an important position for them in the hydrocarbon process industries. The large amounts of thermal energy delivered in the exhaust at usable temperature, and the ability to use a wide selection of fuel, including the waste gas of some processes, have made them extremeley attractive. They are particularly suited for requirements such as the supply of compressed air, hot gases, and mechanical power, or various combinations for these requirements. To simplify discussion, these applications are divided into four major categories: gasifier, integrated pressurized process; extraction; and generator or mechanical drives.

Giant Gas Turbines Get Overhauling. J. E. Fenex, Jr., H. Sims and P. M. Ableson. *Oil Gas J. 59,* 74 (1961) Jan. 23 (3 pp.)

Largest job in the first full-scale turnaround of Petroleum Chemicals' 200-million-pound ethylene plant was the complete dismantling, inspection, and repair of three 13,000-hp gas turbines. A major portion of the turnaround was unique to the company and probably, say authors, to the industry in general. Article details the program.

Heat Exchangers

Rate Exchangers This Computer Way. D. L. Whitley and E. E. Ludwig. *Petrol. Refiner 40,* 147 (1961) Jan. (10 pp.)

Flexible computer program will allow the process designer more time to analyze the effect of variables in exchanger design. Described is such a program for a computer which will handle: convection heat transfer on both tube and shell sides of a heat exchanger; condensation on shell side with convection heat transfer on the tube side. The program is suitable for plain and low-finned tubing used in fixed tube sheet bundles and, by modification, in U-bundles. The computer uses a typewriter and punched paper tape for input and output.

Heat Transfer

Heat Transfer in a Spray Column. T. Woodward. *Chem. Eng. Progress 57,* 52 (1961) Jan. (6 pp.)

Pilot-size columns operated as direct liquid-liquid heat exchangers show that the heat transfer coefficient depends on holdup and on fluidity of the hydrocarbon exchange medium. If a suitable heat exchange liquid can be found, spray columns may prove to be efficient heat exchangers for saline water conversion.

Simultaneous Heat and Mass Transfer. F. Molyneux. *Chem. & Process Eng. 42,* 20 (1961) Jan. (8 pp.)

Important process in many chemical plants is the direct contacting of a fluid with a gas to effect an exchange of heat, such as saturating of gases with water vapor by contact with water and the cooling of hot gases with cold water. All these involve gas-water vapor as the two components, but a similar process involving direct contact of a saturated hot gas stream with a cooler liquid stream of the same composition as the condensate has been utilized for many years in the chemical industry, notably in washing out tar from hot coal-gasification retort gases. These operations are usually carried out in towers filled with packing, the process in each case being one of simultaneous heat plus matter transfer, in which the heat is transferred as sensible plus latent heat. Article describes the design of several processes based on this type of transfer mechanism.

Mathematical Methods

A, B, C's of Regression and Correlation Analysis. J. B. Willis. *Oil Gas J. 59,* 97 (1961) Jan. 23 (4 pp.)

Statistical methods are uniquely adaptable to the task of studying complex processes, and are powerful tools in the hands of the process engineer who learns how and when to use them. Two of the techniques are discussed.

Temperature Measurement

Automatic Precise Recording of Temperature. G. S. Ross and H. D. Dixon. *J. Research Nat. Bur. Standards 64C,* 271 (1960) Oct.-Dec. (5 pp.)

Apparatus is described which automatically and continuously records small temperature changes. The

principal components are a platinum resistance thermometer, a modified Wheatstone bridge, a direct current amplifier and a potentiometric, strip-chart recorder. Frequent zero checking is unnecessary because the system is extremely stable. In systems where the general dependence of temperature on time is known, a nearly uniform change of 0.0001°C/minute is easily discernible over a recording period of 10 minutes or more. However, the measurement of temperature at any given instant is limited by an inherent electronic noise band of 0.0004°C. A similar arrangement, using a thermocouple pair and a potentiometer instead of the platinum thermometer and the Wheatstone bridge, also is described.

Valves

Flow Area Equations for Rating Poppet-Type Valve Capacity. D. J. Lapera. *Design News 16,* 46 (1961) Jan. 30 (4 pp.)

First consideration in most valve design problems is the valve element size necessary to obtain a predetermined capacity rating for some specific application. Other equally important considerations such as temperature, material in contact with line fluid, life and method of actuation usually follow. Article deals with calculating area of flow through the seat of one specific type of valve element, and how, in most cases, this flow area may be used to rate the capacity of the valve.

11. MATERIALS OF CONSTRUCTION, AND CORROSION

Cathodic Protection

Cathodic Protection of Pipe in Casing. M. E. Parker. *Gas 37,* 19 (1961) Feb. (2 pp.)

Effectiveness of the protection afforded to pipe which lies within casing is in large part determined by whether or not the line pipe is insulated from the casing. If installed with the proper equipment, capable of maintaining electrical isolation between the two, there are still three places at which damaging shorts can occur: at the end, through failure or through improper installation of the seals; within the casing, through misalignment, incorrect spacing of supports, support failure or the presence of a short-circuiting foreign object; and outside the casing, by accidental short-circuit between test leads.

Deep Ground Bed for Casing Cathodic Protection. J. P. Daly. *J. Petrol. Tech. 13,* 16 (1961) Jan. (3 pp.)

Application of a deep ground bed (1000 feet) for casing cathodic protection is described. While several ground beds of this type have been used successfully in the cathodic protection of surface lines, this is the first attempt to control external casing corrosion with a ground bed located in the corrosive zone. Early and incomplete data indicate favorable results, with certain minor mechanical problems still to be solved. Actual corrosion protection has not been determined, but field surveys correlate with anticipated equipment performance.

Principles and Applications of Cathodic Protection. K. A. Spencer. *Chem. & Ind.* 62 (191) Jan. 21 (10 pp.)

Article refers briefly to the causes of corrosion and the principles of cathodic protection, and then proceeds more fully to practical applications with reference to engineering design.

Test Tap Installation and Reading Frequency. D. M. Allan. *Pipe Line News 33,* 39 (1961) Feb. (7 pp.)

Cathodic test tap provides a convenient means of obtaining regular electrical measurements in the field. These measurements are essential to the design and maintenance of a cathodic protection system. One company uses test taps to obtain measurements which give pipe-to-soil potentials, pipe-to-pipe potentials and line currents. Article describes types of test taps used and results.

Coatings

Coated Pipeline and Method of Coating Metal Article to Protect It Against Corrosion. G. P. Canevari and J. F. Delahunt (assigned to Esso Research and Engineering Co.) U.S. 2,963,045 (1960) Dec. 6.

Coating and application process for buried pipe is claimed. This comprises a thin first coating (2-5 mils) of 70 parts butadiene-1, 3, and 30 parts vinyl aromatic (styrene) polymer oil, oxidized to 15 per cent oxygen and sprayed or brushed onto the pipe which has been heated to 250°-325°F. This coating is cured by further heating to 800°F with a ribbon burner. A second layer of petroleum or coal tar asphalt at a temperature of 500°-600°F is then applied.

Neoprene and "Hypalon"-Based Coatings. Corrosion-Resistance Investigation. V. Romanovsky. *Corrosion Tech. 7,* 400 (1960) Dec. (4 pp.)

Series of tests has been conducted by the French Oceanographic Research Centre on coatings based on neoprene and Hypalon synthetic rubbers. Five types of coatings were tested, being immersed in sea-water and exposed to sea-air and spray. The tests were carried out at two marine corrosion stations, one at La Rochelle on the Atlantic Coast and the other at Abidjan on the Ivory Coast of West Africa. Report describes the nature of the tests and the conclusions drawn.

The Protection of Gas Service Pipes and Fittings. A. D. L. Copp, W. J. Gooderham and E. Manners. *Chem. & Ind.,* 90 (1961) Jan. 28 (9 pp.)

Paper describes the improvements in the protection from corrosion of gas service pipes and fittings used by the Gas Light & Coke Co. and its successor, the North Thames Gas Board (Great Britain). Service pipes are now being pickled, phosphated, primed, painted internally and then coated and wrapped with bitumen or coal tar enamels, two layers of glass fiber tissue, and an outside layer of paper. These materials are applied with a

fixed head machine under careful control. Specifications for the materials and for the coating and wrapping have been prepared. The finished product is spark-tested and in the last four years the number of feet of tubing per fault has improved from 0.04 to approximately 1500.

The Protection of Structural Steel Against Corrosion. J. C. Hudson. *Chem. & Ind.*, 7 (1961) Jan. 7 (9 pp.)

While paper is concerned with protection of hot-rolled materials, most of the methods discussed are applicable to cold-rolled steel as well. Paper does not attempt to consider the protection of steel against attack by specific chemicals, but rather confines itself to the three natural corrosive media: air, soil and water. Protective coatings considered are paints, metal coatings and other coatings.

Corrosion

Cast Iron and Corrosion in the Gas Industry. H. H. Collins. *Chem. & Ind.*, 32 (1961) Jan. 14 (7 pp.)

Cast iron is a cheap structural material with a useful strength and excellent rigidity, even though it is relatively brittle and will not withstand excessive maltreatment in the form of sudden impacts. Although not intrinsically a corrosion-resistant alloy, it has been found of real use in the gas industry because it has a resistance to soil corrosion as adequate as that of any other economically feasible metal, excellent resistance to alkaline solutions and a useful resistance to many salt solutions. Its history of service in the industry is surprisingly free of failures due to corrosion.

Effect of Flow Rate on the Galvanic Corrosion of Low-Carbon Steels in Sea Water. E. Uusitalo. *Corrosion 17,* 67t (1961) Feb. (4 pp.)

Effect of flow rates ranging from 0 - 5 meters/sec on the galvanic corrosion of low-carbon steels in sea water at 0°C has been studied by: 1) recording current-potential curves of the steels, and 2) measuring the potentials, current strengths and weight losses of galvanic cells formed by the steels in pairs. The corrosion of the steels forming galvanic cells was found to be up to 15 times as great at high rates of flow as in standing sea water, but the variation of the flow rate did not alter the order of nobility of the examined steels.

Practicality of Establishing Threshold Values to Eliminate Stress Corrosion Failures in Metals and Alloys. H. Suss. *Corrosion 17,* 61t (1961) Feb. (6 pp.)

Review is offered on the significance of many factors which could affect the stress corrosion behavior of materials. These include such items as 1) method of test, 2) variations normally present in the materials conforming to the same specifications, 3) slight variations in test environment or metallurgical structure of the metal, 4) accelerated corrosion attack (galvanic or crevice), 5) residual stress, and 6) nature of corrosion attack. Based on this review, it was evident that all factors do not act independently; instead, there is a complex mutual interaction.

Paints

Organic Protective Coatings. A. T. S. Rudram. *Chem. and Ind.*, 1608 (1960) Dec. 31 (9 pp.)

The metallurgist, the chemical engineer and the operator of industrial plant have much vital information to give the paint technologist when the protection of industrial equipment by paint is to be specified. The paint technologist has a range of protective weapons in his armory but can only design the technically correct defense if all the information is at his disposal. Consultation between the parties concerned should commence at the design stage and full discussion of all relevant information should be encouraged, says author.

12. ANALYTICAL METHODS AND TESTS

Air Pollution

Application of Gas Chromatographic Methods for Air Pollution Studies. L. S. Ettre. *J. Air Pollution Control Assoc. 11,* 34 (1961) Jan. (10 pp.)

Gas chromatography has two limitations in its application to pollution studies. The first is that if components of a wide boiling range or different characters are present in the sample, the analysis often cannot be carried out in one run because it is very hard to find "general" chromatographic columns. The second limitation is that, although gas chromatography shows an extremely high sensitivity, it is not high enough for air pollution studies when using standard analytical techniques.

Carbon Dioxide

Use of Four-Electrode Conductometry for the Automatic Determination of Carbon Dioxide and Ammonia in Concentrated Scrubbing Water of Coke Oven Gas. E. Barendrecht and N. G. L. M. Janssen. *Anal. Chem. 33,* 199 (1961) Feb. (5 pp.)

Four-electrode conductometric procedure is used for the automatic determination of carbon dioxide and ammonia in concentrated scrubbing water of coke oven gas. Accuracy is about 2 or 3 per cent owing to small and variable amounts of substances with an electrolytic nature. Carbon monoxide and oxygen do not interfere.

Chromatography

Notes on the Chromatograph in Use in the Gennevilliers Central Testing Laboratory. H. Dumay. *J. Ind. du Gaz 84,* 523 (1960) Dec. (5 pp. French text.)

Account is given of the various improvements effected on the chromatograph described earlier (see *Gas Abstracts 14,* 148). Modifications have resulted from the practical utilization of a device currently used in numerous laboratories.

The Separation of Hydrogen, Deuterium and Hydrogen Deuteride Mixtures by Gas Chromatography. P. P. Hunt and H. A. Smith. *J. Phys. Chem. 65,* 87 (1961) Jan. (3 pp.)

The resolution and analysis of the components of hydrogen-deuterium mixtures have been accomplished by gas chromatography at 77°K. Neon was employed as the carrier gas, and the column was chromia deposited on alumina. Otrhohydrogen and parahydrogen did not separate on the chromia-alumina column. The separation factor for hydrogen deuteride and deuterium was much greater than that for hydrogen and hydrogen deuteride. The complete separation of deuterium and hydrogen deuteride was also obtained on a silica gel column with hydrogen as the carrier gas, whereas a charcoal column produced very little separation.

Some Analytical Aspects of Hydrogen Exchange Between Hydrocarbons and Sulfuric Acid. A. Y. Mottlau. *Anal. Chem. 33,* 293 (1961) Feb. (5 pp.)

Analytical aspects of hydrogen exchange between hydrocarbons and sulfuric acid are explored using tritium as the label and radioassaying gas chromatography as the analytical method. Application of the techniques involves characterization of paraffins, determination of saturates in unresolved chromatographic peaks, and differentiation of paraffins and naphthenes in the naphtha range.

Density

Some Comments on the Construction and Operation of the Gas Density Balance. E. A. Johnson, D. G. Childs and G. H. Beaven. *J. Chromatography 4,* 429 (1960) Dec. (6 pp.)

Slightly modified gas density balance is described, incorporated into vapor-phase chromatography equipment designed for simple maintenance. The newer detectors have not rendered this type of instrument obsolete since it has a range of properties possessed by no other single detector.

Dust Determination

Automatic Techniques of Airborne Particle Counting. Part II. A. Lieberman and J. Stockham. *Air Eng. 3,* 37 (1961) Jan. (3 pp.)

Simulated conditions were created to study the effects on the particle count of a newly completed ultraclean room when used routinely. At zero activity, the particle concentration in the room varied near 100 particles/liter of air. This concentration included submicron particles almost exclusively. The concentration of particles larger than 1 micron was approximately 10/liter. No particles larger than 4 microns in diameter were found. These values can be compared with those found in dust-free hoods of the type in general use, which usually emit no particles larger than 1.5 microns.

Gas Analysis

Ionization Methods for the Analysis of Gases and Vapors. J. E. Lovelock. *Anal. Chem. 33,* 162 (1961) Feb. (17 pp.)

General physical basis of ionization methods of gas analysis and the technique of the method, including the calibration and testing of detectors, are considered. The physical basis, scope, limitations, and construction of the individual ionization detectors are also discussed as are their applications to gas chromatography and gas analysis.

Hydrocarbons

Method for Determining Total Hydrocarbons Dissolved in Water. A. H. Wehe and J. J. McKetta. *Anal. Chem. 33,* 291 (1961) Feb. (3 pp.)

General method is developed for determining the amount of gas dissolved in water. It is based on Henry's law, and assumes that the gas is in equilibrium with the water. The method is applied to the *n*-butane-1-butene-water system.

Metering

A Wet Test Meter for Low Flows, High Pressures. W. M. Miller. *Ind. Eng. Chem. 53,* 127 (1961) Feb. (4 pp.)

Article describes development of a high-pressure wet test meter for measuring hydrogen at rates as low as 0.2 SCF/hr at pressures of 1000 psig. The rotor in the meter has a capacity of 1/160 cu ft per revolution compared to 1/28 cu ft per revolution for the rotor in the smallest commercially available wet test meter. Meter has operated for more than 2000 hours without trouble.

Oil Shale

Ultimate Composition of Organic Material in Green River Oil Shale. J. W. Smith. *U.S. Bur. Mines Rep. Invest 5725,* (Washington, D.C.: U.S. Dept. of the Interior, 1961, 16 pp.)

Method of determining the ultimate composition of the organic material in Green River oil shale was developed. It involves concentration of the organic material by mineral removal with HCl and HF acids. Method was applied to 10 oil-shale samples composited to represent 25 gal/ton sections from the Mahognay zone of the Green River formation in Colorado and Utah. Ultimate composition of the organic material was determined on each sample, and these were found strikingly similar.

Porosity

Constant-Pressure Gas Porosimeter. A. H. Heim. *J. Petrol. Tech. 13,* 87 (1961) Jan. (3 pp.)

Method and apparatus for measuring gas porosities of rocks are described. The apparatus can be assembled from commercially available components. In principle, measurements are obtained by volume substitution at constant pressure. The maximum error is not more than 0.3 porosity per cent. Typical results are given.

Radioactivity Applications

The Methane Dosimeter. B. L. Tarmy, W. Bartok and P. J. Lucchesi. *Ind. Eng. Chem. 53,* 147 (1961) Feb. (4 pp.)

One of the major purposes of dosimetry is the evaluation of the extent and nature of chemical reactions. Since the various radiation species react by different mechanisms, it is advantageous to carry out the dosimetry in the same container used in the chemical study with a substance of the same density and composed of the same elements. This is especially advantageous when attempting to correct for such different mechanisms by calculation. Report describes a chemical dosimetry technique that satisfies these conditions. Method is based on the measurement of the yield of hydrogen produced by radiolysis of methane.

Sulfur Compounds

Mercurimetric Estimation of Thiols, Aryl Trityl Sulfides, and Disulfides. D. C. Gregg, P. E. Bouffard and R. Barton. *Anal. Chem. 33,* 269 (1961) Feb. (3 pp.)

Titrimetric procedure is described for determining thiols, aryl trityl sulfides, and disulfides using mercury (II) as titrant. To an ethanolic solution of the sample, the indicator, diphenylcarbazone, is added and the solution titrated with mercury (II) nitrate to a blue-violet color. Sulfoxides, sulfones and disulfides do not interfere.

13. BASIC SCIENCE

Carbon

Studies on the Electrochemistry of Carbon and Chemically-Modified Carbon Surfaces. B. B. Arnold and G. W. Murphy. *J. Phys. Chem. 65,* 135 (1961) Jan. (6 pp.)

Some factors which influence the behavior of carbon electrodes in contact with aqueous sodium chloride solutions are analyzed. A concentration cell method for identifying finely divided carbon electrodes as cation- and anion-responsive types has been developed. Commercial graphites investigated have been found to be cation-responsive; however, anion-responsive electrodes have been prepared by the adsorption on graphite of certain organic compounds. Possible half-cell reactions are discussed for both electrode types and the electrochemical capacities of some electrodes are reported.

Catalysts

Adsorption Studies on Raney Nickel. R. J. Kokes and P. H. Emmett. *J. Am. Chem. Soc. 83,* 29 (1961) Jan. 5 (3 pp.)

Chemisorption measurements at −195° for carbon monoxide on a W-6 Raney nickel catalyst degassed at 400° indicate that the catalyst surface consists of 20% metal and 80% nonmetal. The adsorption of hydrogen on such a sample in the range −78 to 0° is in agreement with this interpretation. The average pore diameter of the Raney nickel catalyst was found to be 84A.

Diffusion

Heat Diffusion in Gases, Including Effects of Chemical Reaction. C. F. Hansen. *ARS J. 30,* 942 (1960) Oct. (5 pp.)

Diffusion of heat through gases is treated where the coefficients of thermal conductivity and diffusivity are functions of temperature. The diffusivity is taken proportional to the integral of thermal conductivity, where the gas is ideal, and is considered constant over the temperature interval in which a chemical reaction occurs. The heat diffusion equation is then solved numerically for a semi-infinite gas medium with constant initial and boundary conditions. These solutions are in a dimensionless form applicable to gases in general, and they are used, along with measured shock velocity and heat flux through a shock reflecting surface, to evaluate the integral of thermal conductivity for air up to 5000°K.

Weak, Nonequilibrium, Diffusive Waves in a Dissociated Gas. F. K. Moore and J. T. Curtis. Proc. Heat Transf. Fluid Mech. Inst., Stanford, Calif., June 15-17, 1960; Stanford Univ., 1960 (15 pp.) [From *Appl. Mech. Rev. 14,* 52 (1961) Jan.]

Purpose of theoretical study is to deal with a relatively simple problem of viscous wave generation in a gas subject to nonequilibrium effects. A semi-infinite region filled with a diatomic gas at rest, which is excited to some equilibrium level of dissociation or vibrational excitation, is considered. The boundary of this region is considered to be a plane material surface in contact with the gas, and at a temperature equal to that of the gas.

M. Morduchow, USA

Fluid Flow

Contribution to the Approximation Theory of Compressible Turbulent Boundary Layers. A. Walz. Dtsch. Versuchsanstalt Luftfahrt, Ber. 84 (1959) Mar. (56 pp. German text.) [From *Appl. Mech. Rev. 14,* 46 (1961) Jan.]

Previous method for compressible laminar and turbulent boundary layers is further developed to include heat transfer. At first, general integral relations are derived for the temperature field analogous to those existing for the velocity field. The lowest order of these are selected to provide an energy and a momentum equation for calculation.

P. S. Granville, USA

Correlation of the Total Emissivity of Carbon Dioxide and Water Vapor. J. T. Bevans. (New York: ASME Paper No. 60-WA-175; 12 pp. $1.00/copy; $0.50 to members.)

Use of the exponential transmission function (Beer's law) to describe the thermal-radiation characteristics of gases has been shown to be incorrect for the total-energy case. Data for the total emissivity of carbon dioxide and water vapor have been correlated by functions predicted by theory and confirmed by experiment. The correct functional relations established by these correlations are required for the computation of the geometrical factors involved in radiation heat transfer with a combustion gas present.

Flow Measurement by Differential Pressure. A. Linford. **Part 1.** *Coke and Gas 22,* 526 (1960) Dec. (4 pp.); **Part 2.** *Coke and Gas 23,* 9 (1961) Jan. (5 pp.)

Most notable advance in the fluid flow field in recent years has been the development of the electromagnetic flowmeter. Apart from this, and one or two developments of lesser importance, advances have been confined to the improvement of existing principles which have been in common use for years. Most important of these is the differential pressure system of flow measurement, and articles are confined to the consideration of some of the major developments in this field, with some indication of the practical application of these devices. Part 1 deals with the Dall tube and Part 2 with the Dall-Pitot tube.

The Influence of Mach Number and Heat Transfer on the Law of the Wall in Turbulent Flow. J. Rotta. *Z Flugwiss. 7,* 264 (1959) Sept. (11 pp. German text.) [From *Appl. Mech. Rev. 14,* 45 (1961) Jan. (2 pp.)]

Similarity law of turbulent flow along a wall is extended to the case of compressible flow with heat transfer. Additional parameters used are a Mach number and heat transfer coefficient based on shear velocity. Equations are given for the velocity and temperature distributions in the fully turbulent region.

W. L. Haberman, USA

Rapid Chemical Reaction in a Laminar Boundary Layer. S. K. Friedlander and M. Litt. *Appl. Scient. Res. (A) 8,* 403 (1959) No. 6 (10 pp.) [From *Appl. Mech. Rev. 14,* 47 (1961) Jan.]

After making the usual expedient assumptions, the equations of the compressible laminar boundary layer with chemical reaction are simplified so that the specific enthaply of the mixture and the concentrations of the species admit solutions which are linearly dependent only upon the local velocity. All details can be solved explicitly.

S. -F Shen, USA

Some Effects of Particle-Particle and Particle-Fluid Interaction in Two Phase Flow Systems. R. L. Peskin. Proc. Heat Transf. Fluid Mech. Inst., Stanford, Calif., June 15-17, 1960; Stanford Univ., 1960 (16 pp.) [From *Appl. Mech. Rev. 14,* 47 (1961) Jan.]

Intensity of motion and diffusivity of a single particle suspended in a turbulent fluid is discussed. The statistical behavior of particle motion is considered for the case of an isolated particle and for the case in which other similar particles present in the fluid exert pressure forces on the particle. The pressure forces which are present when more than one particle is in motion in a fluid is approximated as an inverse fourth power special force.

C. T. Chang, Sweden

Fractionation

Dynamic Analysis of Bubble Plate Performance. H. S. Mickley, L. A. Gould and L. M. Schwartz. *Can. J. Chem. Eng. 39,* 14 (1961) Feb. (13 pp.)

Frequency response method is examined as a possible experimental method for the simultaneous determination of liquid mixing, plate efficiency, vapor-liquid equilibrium, and liquid holdup on single bubble tray. The analytical results used to interpret the measurements are based on a linearized model. Despite this idealization, systems exhibiting marked curvature of the liquid-vapor equilibrium relation are adequately represented. Systems showing very significant enthalphy effects are treated quantitatively when the liquid on the plate is perfectly mixed.

Approximate Solutions of Conduction of Heat Through Non-Homogeneous Medium. C. Tien. *Can. J. Chem. Eng. 39,* 42 (1961) Feb. (3 pp.)

By comparing the respective difference equations of heat conduction through homogeneous and nonhomogeneous media, an approximate analogy is established. This analogy enables the determination of the solution of conduction through a nonhomogeneous medium in terms of the known solution for homogeneous cases. An illustrative example is included to demonstrate the working details.

Heat Transfer

Numerical Solution of the Heat Conduction Equation. Y. L. Luke. *Chem. Eng. 68,* 95 (1961) Jan. 9 (8 pp.)

Problems of heat conduction and diffusion are of considerable importance to chemical engineers. Numerical analysis is concerned with theoretical and practical development of efficient mathematical techniques for the numerical solution of applied problems. Because applied mathematics ultimately reduces to numerical data, knowledge of numerical analysis is essential. To illustrate some of its facets, an examination is made of the numerical solution of the heat conduction equation in one dimension in some detail.

High Temperatures

The Image Furnace as a Research Tool. N. K. Hiester and R. E. de la Rue. *ARS J. 30,* 928 (1960) Oct. (11 pp.)

In an image furnace, regardless of whether the radiating source is the sun, the crater of a carbon arc or a luminescent flame, the optical system does no more than collect as much of the emitted energy as possible and focus it in a concentrated form in a single region. Article provides a guide to the literature covering some of the important theoretical and practical aspects of image furnaces and their operation. In addition, some of the research areas where these devices have been used are briefly described.

Mass Transfer

Mass Transfer from Fluid and Solid Spheres at Low Reynolds Numbers. C. W. Bowman, D. M. Ward, A. I. Johnson and O. Trass. *Can. J. Chem. Eng. 39,* 9 (1961) Feb. (5 pp.)

Analysis presented for fluid spheres is based on a study by Friedlander of mass transfer around solid spheres. A more elaborate concentration profile through the boundary layer has been used in the present investigation and

the result reported for solid spheres differs about 8 percent from that given by Friedlander. The more interesting details of the mathematical treatment and the machine computation of the resulting differential equations are included.

Mathematical Methods

Powerful Tool: Statistical Mechanics. J. S. Dahler. *Chem. Eng. 68,* 111 (1961) Jan. 9 (8 pp.)

Collected under the title, statistical theory of transport phenomena, are many topics of theoretical, physical and chemical research that directly concern the chemical engineer, particularly the development of molecular interpretations for the bulk transport of properties of matter. Author presents status report on the statistical theory of transport phenomena.

Nitrogen

Emission Spectra of Flames Supported by Active Nitogen. K. R. Jennings and J. W. Linnett. *Trans. Faraday Soc. 56,* 1737 (1960) Dec. (7 pp.)

Visible and ultraviolet emission spectra of flames produced by introducing 16 substances into a stream of active nitrogen have been photographed. The CH red and violet systems are the most prominent features of the spectra of flames given by hydrocarbons and although the CH 4315 A band is present, the CH 3889 A band is not observed. A complex group of heads in the region of 3290 A was also observed in the spectrum of hydrocarbon flames and this has been tentatively assigned to the cyanogen molecule or to a species formed from it.

Radioactivity Applications

The Decomposition of Methane in the Negative Glow. A. W. Tickner. *Can. J. Chem. 39,* 87 (1961) Jan. (9 pp.)

Decomposition of methane was studied in the negative glow of a dc discharge at pressures of 0.30 and 0.050 mm. The discharge tube was cooled by liquid or solid nitrogen. Main products were ethane, ethylene and acetylene in addition to hydrogen and a nonvolatile product which appeared mainly on the cathode as a solid having the formula $(CH)_n$. Smaller amounts of propane, propene, propyne, butane, butene, butadiene and pentene were also found. Lowering the temperature of the discharge tube from —196° to —210°C greatly increased the amount of ethylene recovered.

Shock Waves

The Propagation of Shock Waves of Constant Strength. A. G. Mackie and D. G. Weir. *Proc. Camb. Phil. Soc. 56,* 64 (1960) Jan. (11 pp.) [From *Appl. Mech. Rev. 14,* 52 (1961) Jan.]

Conditions necessary for the propagation of a constant strength plane shock wave through a gas in one-dimensional unsteady motion are examined. Two problems are investigated: the passage of a shock through a simple centered expansion wave; and the passage of a shock through a region of gas initially at rest and having a prescribed density variation.

Low-Density Shock Tube for Chemical Kinetics Studies. S. C. Lin and W. I. Fyfe. *Phys. of Fluids 4,* 238 (1961) Feb. (12 pp.)

Some problems concerning the extension of high-temperature shock tube experiments to low gas densities are discussed. Specific examples are cited on the operation and performance of a 24-in. diam shock tube constructed for chemical kinetics studies at gas densities in the neighborhood of 10^{-5} normal atmosphere. Some preliminary results on the dissociation and ionization rates, as well as the visible radiation profile, behind strong normal shocks in air at these low densities are presented.

Thermodynamics

Applied Hydrocarbon Thermodynamics. Part 25. Summary of the Previous 24 Parts. W. C. Edmister. *Petrol. Refiner 40,* 157 (1961) Jan. (4 pp.)

Series to date is recapitulated. In the areas covered, emphasis has been on data compilations and calculation methods as the development and use of these are the essence of applied thermodynamics. As required, the equations involved are developed from basic concepts. Completely rigorous theoretical developments are not given in all cases. Many empirical correlations are included. Material presented thus far is being published in book form.

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Instrumentation
Instruments and Control Systems
Izvestiva Akademii Nauk S. S. S. R. Otdelenie Khimicheskikh Nauk (Russian)
Khimiya i Tekhnologiya Topliva i Masel (Russian)
LP-Gas
Lubrication
Lubrication Engineer
Mathematical Aids to Computation
Mechanical Engineering
Metals, Journal of
National Aeronautics and Space Administration Memorandum
National Fire Protection Association Quarterly
National Gas Bulletin of Australia
National Petroleum News
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Nucleonics
Oil and Gas Journal
Optical Society of America, Journal of
Organic Chemistry, Journal of
Petro/Chem Engineer
Petroleum (British)
Petroleum Engineer, The (Drilling and Producing)
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Petroleum Refiner
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Physical Chemistry, Journal of
Physics and Chemistry of Solids (British)
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Physics Today
Pipeline Engineer
Pipe Line Industry
Pipeline News
Power
Producers Monthly
Product Engineering
Progress (Pakistan)
Public Utilities Fortnightly
Research/Development
Research, Journal of, A. Physics and Chemistry
Research, Journal of, B. Mathematics and Mathematical Physics
Research, Journal of, C. Engineering and Instrumentation
Review of Scientific Instruments
Revue Generale du Gaz (Belgian)
Rivista dei Combustibili (Italian)
Science
Scientific & Industrial Research, Journal of, A. General (India)
Scientific & Industrial Research, Journal of, B. Physical Sciences (India)
Scientific Instruments, Journal of (British)
Solid-State Electronics
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Technical News Bulletin
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U.S. Patents
Uspekhi Khimii (Russian)
World Oil
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